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ENERGY RESOURCES CONSERVATION BOARD
Calgary Alberta

DRILLING SPACING UNIT TARGET AREA REQUIREMENTS
FOR OIL AND GAS WELLS DRILLED
IN THE GRANDE PRAIRIE AREA

Decision 80-8
Application 800050

1 THE APPLICATION

Upon receipt of applications by the Agricultural Committee of the Grande Prairie Chamber of Commerce, the Albright Surface Rights Group, the Bear Lake Farmers' Rights Group, and the Elmworth Surface Rights Group (Farm Groups), the Energy Resources Conservation Board (ERCB) called a public hearing to consider the drilling spacing unit target area requirements for future oil and gas wells to be drilled in the Grande Prairie area, comprising Townships 69 to 76 inclusive, West of the 6th Meridian to the Alberta/British Columbia border, hereinafter referred to as the Grande Prairie area. The hearing was held in Grande Prairie on April 21, 22, and 23, 1980, with Vernon Millard, N. Strom, P.Eng., and G. A. Warne, P.Eng., sitting.

The parties who appeared at the hearing are listed in Appendix I.

2 BACKGROUND TO THE APPLICATION

Spacing and target area requirements for oil and gas wells have been reviewed on several occasions. The most recent review occurred in April 1978 following a request by agricultural groups to extend the provisions for oil and gas well target areas in effect in southeastern Alberta to the remainder of the province. These target area provisions are shown in Figure 1.

Following the most recent review the ERCB concluded that adoption of northeast quadrant target areas would provide some benefits to farm operations but would create other problems and that on balance "the detrimental effects of province wide target area changes outweigh the local advantages to the farmer". The Board also stated that "this does not preclude that in certain farming regions with compatible petroleum ownership and suitable geological characteristics the benefits to agricultural operations could be significant enough so as to warrant target changes".

3 ISSUES

Three main issues identified were:

(a) The need to change the drilling spacing unit target areas in the Grande Prairie area.

(b) If there is a need to change the target areas, then

  (i) the changes that should be adopted, and

  (ii) the timing and manner of implementation.

(c) The need to amend regulatory and policy provisions respecting the issuance of well licences to reduce problems between landowners and the oil and gas industry.

4 NEED TO AMEND THE DRILLING SPACING UNIT TARGET AREAS IN THE GRANDE PRAIRIE AREA

The applicants contended that the current target area regulations result in wells being located in the centre of cultivated fields and the wishes of the landowner do not receive appropriate consideration by the industry. In their view this results in both substantial inconvenience to the agriculture industry and reduced agricultural production. They submitted that if wells were located in the corner of quarter sections, along property boundaries or adjacent to natural obstructions in the fields this impact would be significantly reduced. They stated that often the access road has more impact on agricultural operations than the well site. The applicants also submitted that well sites should be a minumum of 400 metres (1320 feet) from residences.

The oil and gas industry interveners generally contended that wells should be located more or less in the centre of spacing units to protect the equity of the mineral lease owner, and to permit exploration for oil and gas on common target areas. They also submitted that irregular development patterns could lead to a lower recovery of oil or gas. Several of the industry interveners suggested that the current regulations provide sufficient flexibility to permit wells to be located so as to minimize the impact on agricultural operations. They also expressed doubt that the conflict of oil and gas industry operations with agricultural operations would be significantly reduced by a shift to northeast target areas. The industry interveners stated that the proposed 400 metres (1320 feet) separation distance between wells and residences would result in wells being located near the centre of quarter sections and, in some cases, could prohibit drilling on a mineral owner's quarter section lease.

After carefully considering the evidence, the ERCB concludes that:

(a) From an agricultural point of view a well site would have minimum impact if it were located in the corner of the quarter section, adjacent to property boundaries or adjacent to a natural obstruction in a field.

(b) The current target area regulations which provide for a central common target area as illustrated in Figure 2 tend to promote the location of wells in the middle of quarter sections.

(c) Most exploratory wells drilled with oil and gas objectives could be located near the centre of the section with the access road along quarter section lines. (This would minimize the impact on agricultural operations without having a significant impact on the mineral owner. In some cases a well location toward the centre of a quarter section might be justified for geological reasons. However, in such instances the well site should be made as compatible as practical with agricultural operations such as by selecting locations and access roads adjacent to natural surface obstructions.)

(d) The development of oil pools usually requires at least one well per quarter section and to promote conservation the wells should be located on a reasonably uniform pattern. (Target areas located in the extreme corner of the quarter sections could cause some equity problems especially where oil development has commenced on the central target area pattern. However, northeast corner target areas would normally be acceptable especially where they are prescribed prior to the discovery of a reservoir.)

(e) The requirement of a minimum 400 metres separation between well sites and residences could result in wells being located near the centre of fields and may prevent drilling of certain quarter section drilling spacing units.

The ERCB finds that target areas should be altered in the Grande Prairie area to better accommodate the needs of the agricultural industry without seriously affecting oil and gas development.

5 DESIRABLE AMENDMENTS TO SUBSISTING TARGET AREA PROVISIONS

The Farm Groups proposed that the target areas be restricted to the extreme northeast corner of the spacing units or along property boundaries. They fully recognized that under certain circumstances it would be necessary to locate wells in cultivated fields but contended that where this was the case the well sites and access roads should be adjacent to surface obstructions wherever possible. They were prepared to accept the ERCB's assessment as to whether a location away from the corner of the spacing unit or property boundary, was necessary.

The oil and gas industry did not agree with the restrictions proposed by the Farm Groups and contended that maximum flexibility was essential for exploration.

After reviewing the evidence, the ERCB concludes that:

(a) The proposal of the Farm Groups that the target areas be restricted to the extreme corner of the spacing unit or along property boundaries is too restrictive, could lead to very irregular patterns, and could result in serious equity problems.

(b) Notwithstanding the above, corner target areas for quarter section spacing units are reasonable, provided allowance is made for setbacks from the lease boundaries to accommodate normal wellbore deviations and to meet minimum setback requirements from road allowances of municipalities and the minimum distance requirements of 100 metres from surface improvements by the ERCB. Where setback requirements of municipalities from a surface improvement other than an occupied dwelling or public facility are less than 100 metres and gas containing hydrogen sulphide is not anticipated, the ERCB is prepared to consider reducing the setback distance where written consent of the owner of the surface improvement is provided.

(c) To encourage a well to be located as close as possible to the corner of the quarter section, the target area could be divided into "primary" and "secondary" areas. As illustrated in Figure 3, the primary target area for quarter section spacing would be an area, usually 200 metres by 200 metres in the northeast corner of the spacing unit. The secondary target area would be the remainder of the prescribed target area. The target area for a one section drilling spacing unit would be divided into a primary target area in the northeast corner of Lsd 6, having dimensions 200 metres by 200 metres, and a secondary area comprising the remainder of the target area. Well locations would be considered for approval in the secondary area, where the proposal is based on geological, conservation, or equity reasons.

(d) It is evident from Figure 3, that with northeast target areas as proposed the only available primary common oil/gas target area is located in the northeast corner of Lsd 6. Such a restriction in well location would minimize the impact of exploratory drilling on agricultural operations.

(e) If the provisions described in (c) above were adopted, an application to drill a well in the primary target area could be processed by the Board in a straightforward manner provided that the landowner was in agreement with the location. An application to drill a well in the secondary target area could also be processed in a straightforward manner provided the landowner had consented to the location. Where the landowner had indicated disagreement with the proposed well site, the matter would be examined carefully by the ERCB. The applicant would require good reasons related to conservation, geological considerations and, under special circumstances, equity matters to justify a location outside the primary area. The ERCB expects that in some cases it might be necessary to call a hearing to consider the matter.

(f) The target area orientation for the Grande Prairie area should be similar to that adopted for southeastern Alberta.

In summary, the ERCB finds that for the Grande Prairie area the well spacing provisions should be amended to provide for northeast target area orientations and a classification of the target areas into primary and secondary areas as shown on Figures 3 and 4.

6 IMPLEMENTATION OF THE REVISED TARGET AREAS

The Farm Groups contended that any new target area orientation should be implemented as quickly as possible in order to minimize the impact of future drilling on agricultural operations.

The oil and gas industry interveners were particularly concerned about applying any revised target area requirements to oil pools that were already under development and in particular to the Wembley oil pool. They contended that any change in target areas for a developing pool could have a serious impact on the equity of individual lease owners.

They were not as concerned about the impact of corner target areas on the development of gas pools or on exploration prospects.

The ERCB concludes that

(a) while there are difficulties in applying revised spacing targets to existing oil pools both with respect to optimizing recovery from a pool and maintaining the equity of lease owners, the revised target area provisions described above offer sufficient flexibility to overcome these difficulties, and

(b) evidence presented at the hearing suggested that about 60 additional development wells will be drilled in the Wembley oil pool.[1] Where necessary, to accommodate special problems, locations outside the primary area could be utilized and since at least part of the northeast target area is within the subsisting target area a well under the revised target area provisions could be drilled on a pattern that is largely compatible with that already established. By applying the target area change to the Wembley oil pool, the ERCB expects that many of the remaining wells could be located in a manner that would reduce the impact on farming operations without having a serious impact on either conservation or equity.

[1] The principle oil pool under development in the area is the Wembley pool.

Having regard for the foregoing the ERCB plans to issue an SU Order setting out the new target area provisions for the Grande Prairie area. The order will be effective July 1, 1980.

7 REGULATORY AND POLICY PROVISIONS RESPECTING THE ISSUANCE OF WELL LICENCES

The Farm Groups submitted that in many instances the oil industry was not sufficiently concerned about the interests of the landowner in the selection of the well location notwithstanding the flexibility provided in the regulations for the location of wells. They also contended that the negotiations for a surface lease were frequently carried out in a perfunctory fashion and applications for right of entry were made to the Surface Rights Board before serious negotiations had occurred. Additionally, it was implied that applying for a right of entry order before the ERCB had issued a well licence appeared inappropriate.

The oil and gas industry interveners appeared to agree that in some instances the negotiations for a surface lease had not been completed in an optimum fashion, but pointed out the difficulties of reaching agreement.

The Board believes that:

(a) The revised target area system will eliminate some of the present conflicts. The primary target area should lead to location of most wells in an area that the landowner generally prefers. However, the system will permit wells to be located outside the primary area to accommodate the landowner preference or when the ERCB is satisfied that there are other sound reasons for doing so.

(b) Changes can be made to relevant legislation which would reduce confusion and conflicts between the oil and gas industry and the landowners. In particular, the current system which permits the filing of an application for a right of entry order before the ERCB has issued a well licence seems to be inappropriate. Moreover, it is inconsistent with the procedure that applies to the acquisition of surface rights for the construction of transmission lines or pipelines. In those instances an application for right of entry cannot be made to the Surface Rights Board before the ERCB has issued its permit.

The ERCB plans to meet with the Surface Rights Board with the objective of seeking amendments to the relevant statutes.

(c) The location of the access road to the well site should be an integral part of the application to drill the well.

Currently the ERCB does not have jurisdiction with respect to the access road but its location frequently is of prime concern to the landowner and may be one of the reasons why the parties are unable to reach agreement. Furthermore, the absence of any ERCB ruling with respect to the location of the access road places the Surface Rights Board in a difficult position when it considers an application before it.

The ERCB plans to seek amendments to The Oil and Gas Conservation Act to correct this deficiency.

(d) The negotiations between the landowner and the applicant for a surface lease should be conducted in a constructive and business like manner. Where agreement has not been achieved, the applicant is required to provide the ERCB with the name of the surface owner, and a statement setting out the steps taken to acquire the right to the land surface and the reasons why the rights have not been acquired. Oil and Gas Conservation Regulation 2.020(4) and administrative procedures set forth pursuant to that regulation outline this requirement and procedures followed in processing an application for a well licence when disagreement exists between the landowner and the applicant (see Appendix II).

(e) While recognizing that there are many time constraints and uncertainties facing industry, the ERCB believes that drilling operations should be planned to permit adequate advance discussion with the landowner.

(f) The ERCB further believes that for major pool development programs it would be desirable for the industry to meet with landowners to advise them of development plans and discuss any matters of special concern. However, it is recognized that such meetings would not be practical during the exploratory or perhaps the early development stage because of the highly confidential nature of much of the early information. Such meetings would be comparable to the practice described in Appendix III currently followed by those proposing large gas processing plants and other major energy projects.

8 DECISION

After carefully considering all of the evidence, the ERCB has decided

(a) that the target areas for drilling spacing units in the Grande Prairie area described in Figure 2, will be amended to provide for northeast target area orientation and primary and secondary target areas described in Figures 3 and 4,

(b) that the SU order to effect these these changes will be issued effective July 1, 1980, and

(c) that the ERCB will seek amendments to relevant statutes affecting procedures for obtaining well licences and to improve its procedures for considering well licence applications.

DATED at Calgary, Alberta, on 13 June 1980.

ENERGY RESOURCES CONSERVATION BOARD

Vernon Millard
Chairman

N. Strom, P.Eng.
Board Member

G. A. Warne

G. A. Warne, P.Eng.
Acting Board Member

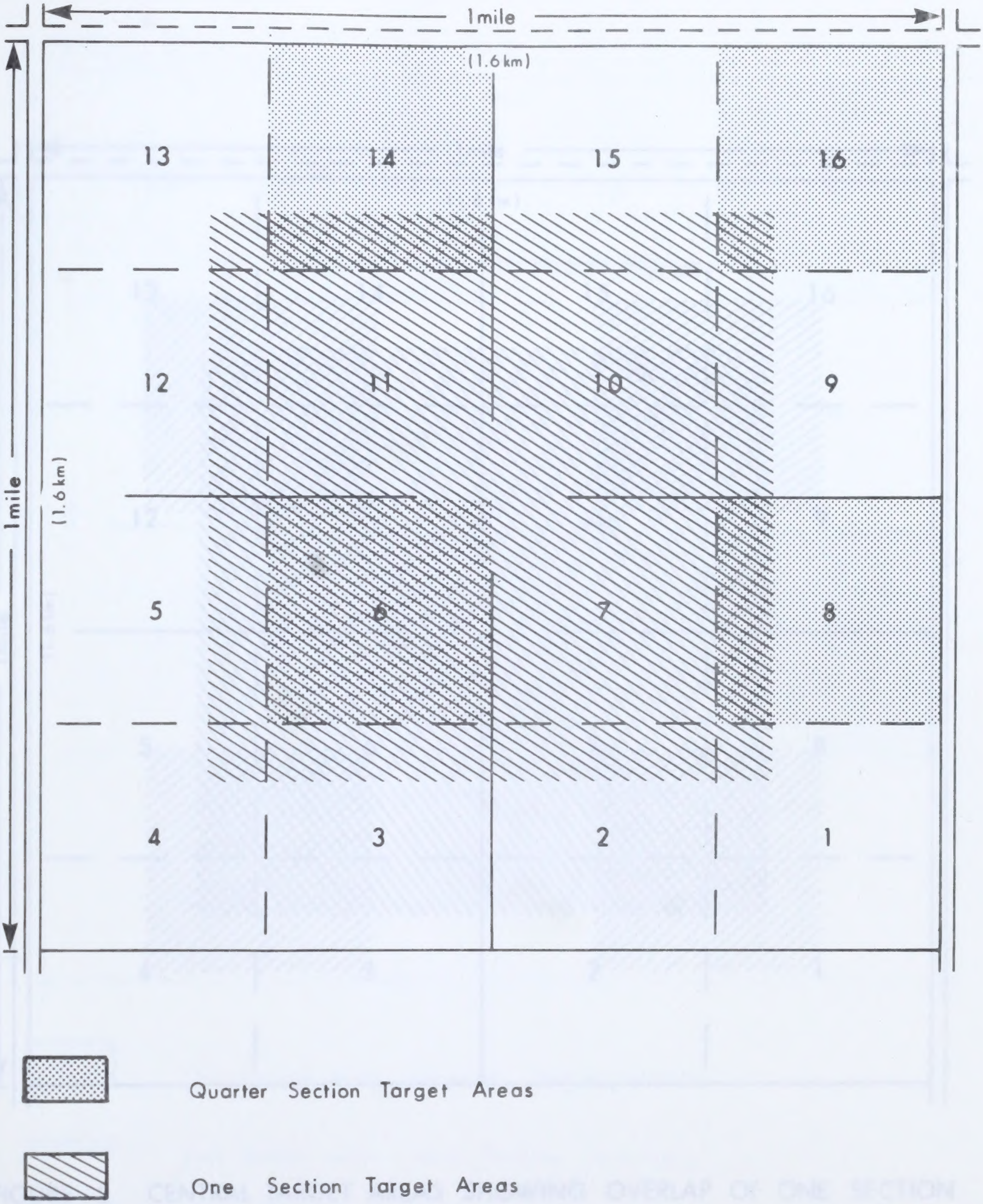


FIGURE 1 DRILLING SPACING UNIT TARGET AREAS SOUTHEASTERN ALBERTA

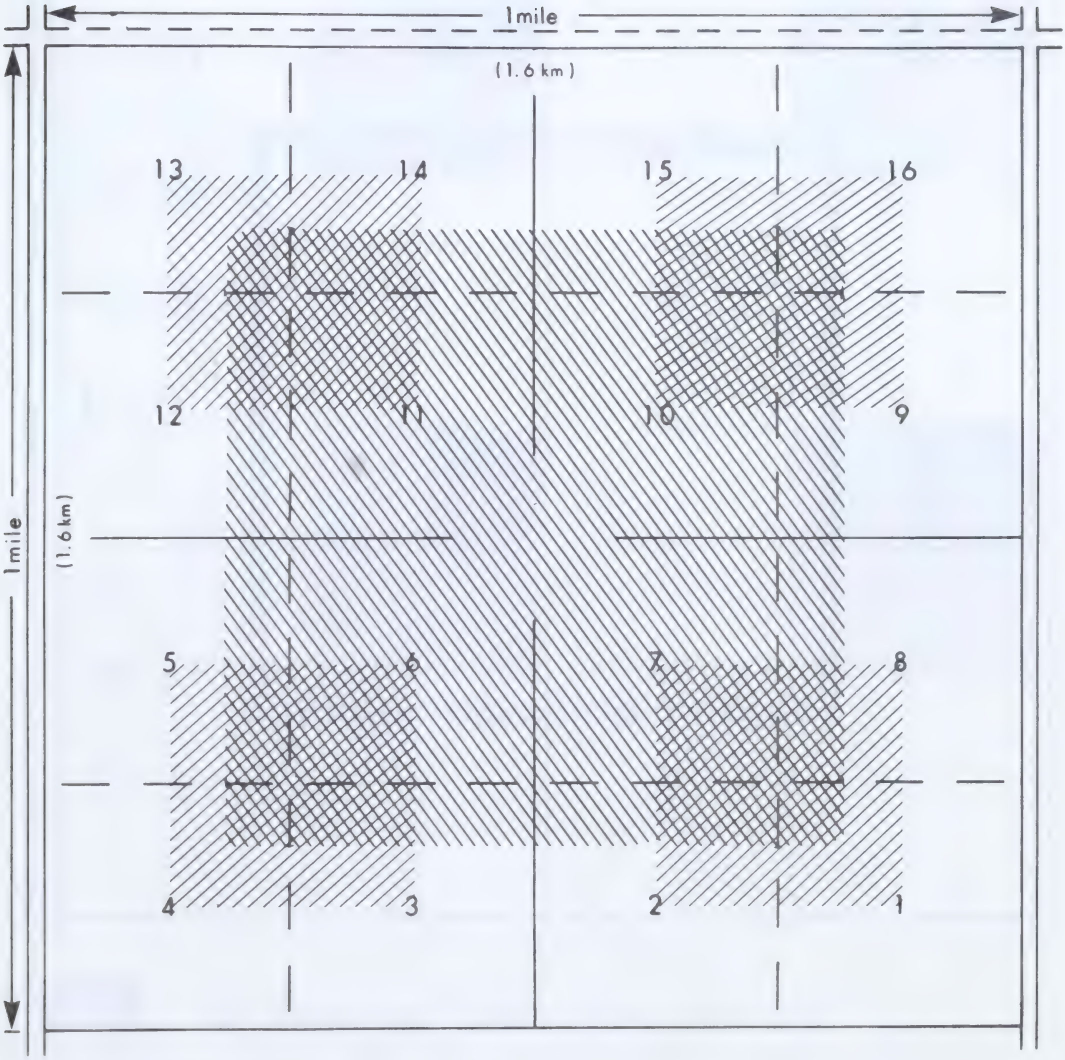


FIGURE 2 CENTRAL TARGET AREAS SHOWING OVERLAP OF ONE SECTION AND QUARTER SECTION SPACING

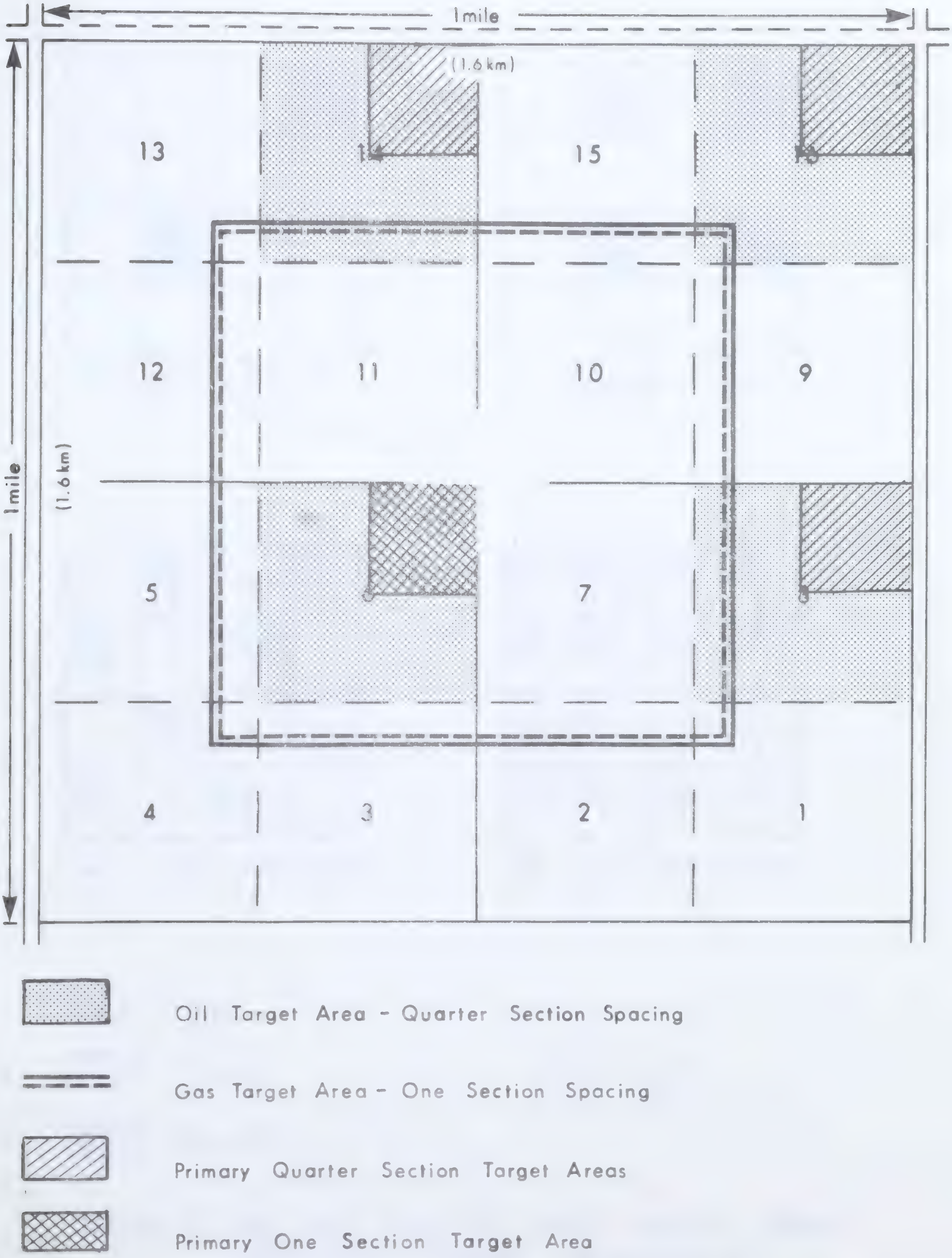
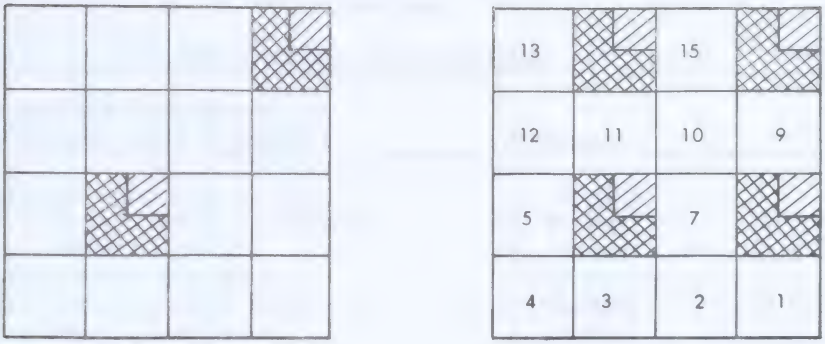
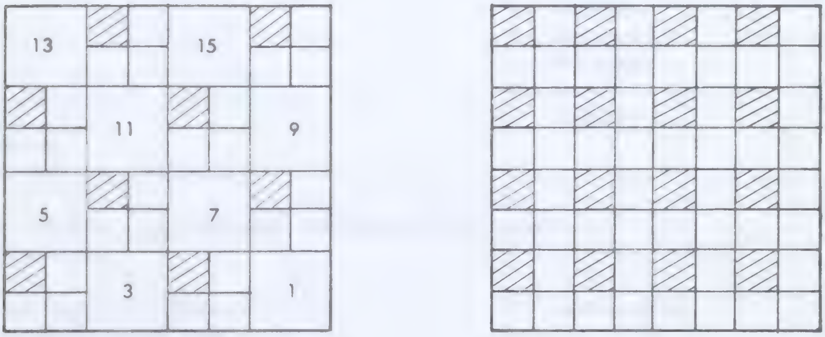

1mile
(1.6km)
1mile
(1.6km)
13
14
15
16
12
11
10
9
5
7
4
3
2
1
Oil Target Area - Quarter Section Spacing
Gas Target Area - One Section Spacing
Primary Quarter Section Target Areas
Primary One Section Target Area

FIGURE 3 PROPOSED TARGET AREAS - GRANDE PRAIRIE AREA



HALF SECTION

QUARTER SECTION



TWO LEGAL SUBDIVISION

ONE LEGAL SUBDIVISION

TARGET AREA

▨ Primary

▩ Secondary

1 Mile = 1.6 Km.
5280 ft.= 1609.3 m.

FIGURE 4 DRILLING SPACING UNIT TARGET AREAS
NORTHEAST TARGET ORIENTATION

Appendix 1 lists the parties who appeared at the hearing and those parties who made a written submission to the Board, but did not appear or were not represented at the hearing.

APPENDIX 1 THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations used in Report)	Witnessess
Agricultural Committee of the Grande Prairie Chamber of Commerce Albright Surface Rights Bear Lake Farm Rights Group Elmworth Surface Rights Group Ray Lake Women's Institute J. Darryl Carter	D. Balisky C. Penson D. Liland, P.Eng. T. Balisky R. Balisky A. Carter W. Paszkawski M. Moore D. Shannon J. Jenzer H. Rowney C. White H. Hrychiw F. Ransden D. Somerville D. McEachern O. Harpe N. Stanley
A. Lozeron Grande Prairie, Alberta	
Grande Prairie Agricultural Development Committee G. Balderston	
Canadian Hunter Exploration Ltd. K. R. MacGregor, P.Eng.	B. Meulenbeld
Canadian Petroleum Association J. E. Lowman	M. McDonald E. Baraniuk, P.Eng. H. Simons
Esso Resources Canada Limited J. E. Lowman	R. Morris H. Simpson, P.Eng. M. Shaw

Sulpetro Limited Dome Petroleum Limited Total Petroleum (N.A.) Limited F. M. Saville of Fenerty Robertson, Fraser & Hatch	P. Zonda, P.Eng. J. R. Moore, P.Eng. T. McGlynn R. J. Bobach, P.Eng. D. Shantz, P.Eng. L. Donaldson J. A. Lore, B. Sc., P.Ag. of McKinnon, Allen and Associates
PanCanadian Petroleum Limited B. Jones	N. Chase B. Stevens, P.Eng.
Texaco Canada Resources Ltd. L. Page, P.Eng. W. F. Muscoby	
Brascan Resources Limited J. Newbert D. A. Repka	
Energy Resources Conservation Board M. Bruni	D. Pearson, P.Eng. Wm. H. Wolff, P.Eng R. Willard, P.Eng. D. Skappak W. McNary, P.Ag. of the Department of Agriculture

APPENDIX II

1 OIL AND GAS CONSERVATION REGULATIONS
LICENCING OF WELLS
APPLICATION FOR LICENCE
SECTION 2.020 subsection (4)

(4) An applicant under this section shall furnish

(a) evidence of any right of access to the land surface on which the well is to be drilled, and if no right to drill on the land surface exists at the time of the application, the name of the land surface owner and a statement setting out the steps taken to acquire a right to the land surface and the applicant's reasons as to why the rights to the land surface have not or could not be acquired, and

(b) Such further particulars concerning the well or proposed surface location of the well as the Board, after examination of the application may require.

2 BOARD ADMINISTRATIVE PROCEDURES WHEN ISSUING WELL LICENCES

The Board administers the regulatory requirements in accordance with the following procedure:

(1) Upon a well licence application being made, and where the application includes evidence of a right to drill on the proposed surface location, and where the application is otherwise in compliance with the provisions of the regulations, the Board will grant the licence without delay.

(2) Where a well licence application is incomplete as to evidence of a right to drill on the proposed surface location, the Board contacts the land surface owner, at the address provided by the applicant, to review the application and to determine the land owner's position respecting the application.

(3) The Board allows a minimum period of ten days for the land surface owner to submit to the Board his objection, either in writing or confirmed verbally and later in writing, as to the location of the well.

(4) Any objection received by the Board will be immediately communicated to the well licence applicant.

(5) The operator is required to indicate that he has made a reasonable effort to negotiate a surface location and that he has explained the geologicai, regulatory,

environmental and technological constraints which determined the choice of well location.

(6) The Board's field staff may be called late in the negotiations between the operator and landowner to visit the site and to meet with the landowner and applicant to encourage attainment of an agreement to the wellsite or proposed changes. This procedure may resolve misunderstandings.

The access road, in addition to the well location, may be considered at the well licencing stage.

(7) Each objection received is considered by the Board and its staff with a view to resolving conflicting views in the most expeditious manner.

(8) The Board limits its consideration to matters of location as objections relating exclusively to matters of compensation are beyond the jurisdiction of the Board.

(9) Following consideration of an objection by the Board, and any further proceedings required to determine the merits of the matter, the well licence is either granted or denied. If the application is denied, the Board would be prepared to consider another application, whether for a change in spacing or for a different location. A hearing is sometimes necessary to consider the matter where an objection is submitted.

(10) Following its decision on the matter, the Board advises the applicant and the owner of its decision.

The Board is aware that these additional requirements, in some cases, lead to delays in obtaining a well licence. However, the Board is of the opinion that such procedures are necessary to ensure that land surface owners affected by the application have notice thereof, as required by section 29 of The Energy Resources Conservation Act, and to enable the Board to fully consider the respective interests of both mineral and surface owners.

APPENDIX III

ENERGY RESOURCES CONSERVATION BOARD
Calgary Alberta Canada

Informational Letter
IL 76-1

TO: All Operators

COMMUNICATION WITH RESIDENTS RE MAJOR ENERGY RESOURCE PROJECTS

The Board in 1974 issued an Informational Letter encouraging those proposing gas processing plants, pump stations and compressor stations to give prior notification of each proposed project to residents near the proposed location. The Board has recently received requests for the provision of additional information and guidance to interested citizens in advance of other major resource projects such as coal mines, petrochemical plants, and electrical generating plants. Those requesting the additional information indicated that they often do not have sufficient information or understanding of an application, even after reviewing the submission of the applicant, to determine whether they should intervene respecting the application. For this reason, the Board is replacing Informational Letter No. IL-PL 74-1 relating to gas processing plants, pump stations and compressor stations with this Informational Letter which relates to all major energy resource projects.

The Board believes it is important that a company proposing to locate a major facility in a community become aware of the concerns of the residents and acquaint them with its plans. The Board is of the view that in many cases it would be beneficial to all parties to hold a public informational meeting before an application is made to the Board for approval of an energy resource project. In some instances, private discussions between representatives of the company proposing the energy resource project and the individual residents of the area may be desirable in place of or in addition to a public meeting. The public meeting or private discussions should encompass the company's plans in the area and the possible impact these plans could have on the local residents.

For the above reason, the Board encourages applicants seeking approval for the construction of major energy resource projects to communicate with the residents in the vicinity of the proposed project and discuss plans with them. Where the means of communication include a public meeting the Board would be prepared to have a representative of it attend the meeting to describe the requirements and procedures applicable to the Board's consideration of the development and the standards which would have to be met. The Board expects that other Government departments and agencies having major responsibilities respecting energy resource projects would also be prepared to have appropriate representatives attend the meetings.

Where communication between the applicant for an energy resource project and residents in the vicinity of the proposed project has taken place, evidence of such communication should be included in the application. In this regard the Board plans to amend the various regulations for which it is responsible to provide for the inclusion of evidence of such discussions in applications for approval of major energy resource projects.

ISSUED at Calgary, Alberta on January 20, 1976.

ENERGY RESOURCES CONSERVATION BOARD

GJ DeSorcy

G. J. DeSorcy
Board Member

AL.1.148

ENERGY RESOURCES CONSERVATION BOARD
Calgary Alberta

KAYBOB SOUTH BEAVERHILL LAKE A POOL
COMMENCEMENT OF BLOWDOWN IN GAS UNIT NO. 1
HUDSON'S BAY OIL AND GAS COMPANY LIMITED

Decision Report 80-9
Application 790560

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1 THE APPLICATION AND HEARING

Hudson's Bay applied under sections 36, 37 and 38 of The Oil and Gas Conservation Act for an amendment of Board Approval No. 995 to permit cessation of injection of residue gas and commencement of blowdown in the

Kaybob South Beaverhill Lake Gas Unit No. 1. Hudson's Bay made a companion application for ratable take of gas from the pool but subsequently withdrew it.

The timing of blowdown of Unit No. 1 was related to the problem of an active water-drive coupled with a high trapped residual gas saturation causing a reduction in recovery. Hudson's Bay submitted that the reduction would be minimized if blowdown rather than other modes of depletion were implemented.

The Hudson's Bay blowdown scheme would consist of converting the injectors into producers and continuing production of the existing producers subject to an individual well critical rate formula to minimize water coning. The current net gas withdrawal (i.e. raw gas production minus residue gas injection) production rate is about 1.74×10^6 m^3/d, which would be increased to about 3.95×10^6 m^3/d if the blowdown scheme were implemented.

Although the application was for blowdown of Unit No. 1 only, Hudson's Bay suggested that subsequent blowdown of Units No. 2 and 3 might also occur.

A public hearing of the application was held on 5 February 1980 by the Energy Resources Conservation Board, with G. J. DeSorcy, P.Eng., N. Strom, P.Eng., and J. A. Bray, P.Eng., sitting. Table 1 contains a list of those appearing at the hearing.

Interventions from four producers in the pool were filed in support of the application. Chevron was the only producer to give evidence specifically stating that it believed blowdown commencing as soon as possible would result in maximum recovery of energy from Unit No. 1.

Three gas purchasing companies filed interventions, with Consolidated and TransCanada filing jointly, taking the position of not being opposed in principle to the application, but rather of seeing serious problems of accommodating the proposal within the provisions of existing gas purchase contracts.

Trunk Line's intervention related to the need for, the cost of, and the timing of construction of pipeline facilities in the field.

The Board issued an interim decision report dated 14 February 1980 in which the commencement of blowdown in Unit No. 1 was approved in principle.

TABLE 1 THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations used in Report)	Witnesses
Applicant	
Hudson's Bay Oil and Gas Company Limited (Hudson's Bay) J. R. Smith M. F. Mackintosh	J. C. Gateman, P.Eng. Dr. G. J. Besserer, P.Eng. D. D. Best R. L. Keto, P.Eng.
Producers	
Chevron Standard Limited (Chevron) L. Sali	J. D. Scott, P.Eng.
Amoco Canada Petroleum Company Ltd. (Amoco) K. F. Keeler	
Mobil Oil Canada, Ltd. (Mobil) G. M. Bates, P.Eng.	
Petrofina Canada Inc. (Petrofina) J. M. Thompson	
Gas Purchasers	
Alberta and Southern Gas Co. Ltd. (Alberta and Southern) W. E. Code, Q.C. F. G. Homer	D. McMorland, P.Eng. J. T. Sullivan, P.Eng. D. A. Sharp, P.Eng.
Consolidated Natural Gas Limited (Consolidated) J. A. Phillips	I. F. Taylor, P.Eng.
TransCanada PipeLines Limited (TransCanada) E. W. H. Mallabone	R. T. Liddle, P.Eng.
Others	
Alberta Gas Trunk Line Company Limited (Trunk Line) H. D. Williamson	V. B. Kromand, P.Eng.

TABLE 1 THOSE WHO APPEARED AT THE HEARING (continued)

Principals and Representatives (Abbreviations used in Report)	Witnesses
Energy Resources Conservation Board staff (Board staff) H. R. Keushnig, P.Eng. L. D. Atwell, P.Eng. F. S. Hsieh, P.Eng. A. L. McLarty M. P. Gobrial	

2 BACKGROUND

The Kaybob South Beaverhill Lake Pool is a large gas-condensate reservoir located about 250 km northwest of Edmonton and containing an initial gas in place of 104 x 10^7 m^3. It is an elongated dolomitized reefoid bank about 50 km in length. The northern part is mainly reef rim and is about 3 km wide and up to 30 m thick. The southern part is about 6 km wide incorporating an extensive backreef area and a reef rim up to 60 m thick. The pool is flanked on the west side by a very large aquifer which is providing a large degree of pressure support particularly to the northern part of the pool.

The pool is at a depth of about 3240 m and had an initial pressure of 32 500 kPa. The gas has a dewpoint of 23 500 kPa and contains 17 mole per cent hydrogen sulphide.

The pool was discovered in 1961 with development taking place proceeding from north to south. Gas cycling commenced in Unit No. 1 in November 1968 under Approval No. 995. The approval provided for production of 4.79 x 10^6 m^3/d of raw gas and the reinjection of all residue gas. Voidage replacement requirements were reduced to 52 per cent in 1971.

Unit No. 2, which is the central portion of the pool and operated by Hudson's Bay, commenced cycling in 1970. Unit No. 3, which is the larger and thicker southern portion of the pool and operated by Chevron, commenced cycling in 1972.

Since commencement of production, the pressure of the pool has declined from 32 500 kPa to about 25 000 kPa. There is only a small pressure gradient along Units No. 1 and 2, but there appears to be a significant pressure sink in Unit No. 3 adjacent to Unit No. 2. Here the pressure has declined slightly below the dewpoint to about 22 000 kPa.

After commencement of production, water intrusion occurred in many wells, reducing productivity and resulting in premature suspension of wells. This condition is most severe in Unit No. 1 where 17 wells have been suspended and the average water cut of the current remaining 24 producers is 172 $m^3/10^6$ m^3 of produced gas. The current average water cuts, in Units No. 2 and 3 are 107 $m^3/10^6$ m^3 and 33 $m^3/10^6$ m^3 respectively.

Water intrusion into wells was initially attributed largely to water coning but a higher than anticipated rate of water influx subsequently became apparent. Recent studies indicate that the residual gas saturation entrapped by invading water is very high.

Dry gas cycling is somewhat more mature in Units No. 1 and 2 than in Unit No. 3. Current average dry gas cuts are 43, 41, and 36 m^3/m^3 respectively.

3 ISSUES

(1) Optimum recovery for Unit No. 1 in view of gas entrapment by water encroachment,

(2) Avoiding possible adverse effects of Unit No. 1 blowdown on Units No. 2 and 3.

4 OPTIMUM RECOVERY FOR UNIT NO. 1 IN VIEW OF GAS ENTRAPMENT BY WATER ENCROACHMENT

4.1 Reduced Recovery Due to Gas Entrapment

Views of Hudson's Bay

Hudson's Bay theorized that the high residual gas saturation, which it believed to be in the order of 45 per cent for Unit No. 1, may be due to the different wettability of vugs compared to that of fractures. Because the vugs are coated with a bitumen making them oil wet, water would tend to move preferentially through the fracture systems and by-pass and trap the gas contained in many of the vugs.

Hudson's Bay cited four methods of evaluating the level of residual gas saturation after water invasion. These in their order of reliability, were: (1) core displacement studies, (2) reservoir performance analysis, (3) core displacement studies in other reservoirs, and (4) thermal decay time (TDT) logs.

Water displacement of restored state cores was done by the Petroleum Recovery Institute in 1979 on four samples from Units No. 1 and 2. These tests gave residual gas saturations ranging from 36.6 per cent to 53.6 per cent, and averaging some 45.1 per cent.

To determine residual gas saturation by reservoir performance analysis, Hudson's Bay plotted pore volume flooded (determined from TDT logs and production data) versus water influx (determined from material balance). This method gave residual gas saturations of 38 and 52 per cent for Units No. 1 and 2 respectively, which converge to about 45 per cent if less migration between Unit No. 1 and 2 were assumed. Hudson's Bay agreed that the overall accuracy of the water influx volume from material balance was dependent on the accuracy of estimated initial gas in place and that overall accuracy of pore volume flooded was dependent on distinguishing well bore coning from area-wide aquifer rise.

Estimates of water table rise by TDT logs gave values for residual gas saturation varying over 10 to 60 per cent. These were considered less reliable than other methods.

It was originally anticipated that ultimate energy recovery (net sales after fuel) for Unit No. 1 would be over 80 per cent of the initial energy in place. However, owing to the rapid water influx coupled with the high residual gas saturation and allowing for gas migration to Unit No. 2, ultimate recovery for Unit No. 1 is now estimated to be only 41.7 per cent of the initial energy in place. As cumulative energy recovery to the end of 1977 was 26.5 per cent, only about 15.2 per cent remains to be recovered by continuation of the cycling operation.

Views of the Board

The Board believes that displacement tests of vuggy, fractured cores cannot be completely relied upon to represent actual circumstances in the reservoir. The Board observes that widespread experience with vertical water encroachment of vugular oil reservoirs shows that residual hydrocarbon saturations achieved tend to be lower than the levels indicated by core tests.

Material balance and volumetric water invasion calculations to determine residual gas saturation, though indicative, are fairly sensitive to assigned estimates of the height of well coning. If coning is underestimated the result is an overestimate of residual gas saturation.

Considering the evidence from several points of view, the Board believes that the residual gas saturation under water encroachment may be a fair degree lower than suggested by Hudson's Bay. The Board suspects that a value in the range of 30 to 35 per cent may eventually prove more correct.

4.2 Methods of Optimizing Recovery

Views of Hudson's Bay

Hudson's Bay studied various depletion schemes to counteract the effect of trapped gas losses. The studies are based on reservoir simulation using Intercomp Resource Development and Engineering Ltd.'s "Black Oil Model".

The model consisted of approximately 2300 grids encompassing the Kaybob South Beaverhill Lake A Pool, Pine Creek D-3, Pine Northwest D-3 A and Bigstone D-3 pools. The model was run in the two-dimensional areal form with a vertical equilibrium option. The original wet gas, the injected dry gas and the aquifer system were modelled as oil, gas and water phases, respectively. Pseudo-relative permeability curves developed from a cross-sectional compositional model were used in the areal model to define the relative flow of the wet gas and injected dry gas.

In the model predictions, production rates of individual wells were controlled to minimize water coning. The individual well rates were thus progressively reduced as the water-gas interface rose. The wells were shut in when the interface reached the bottom of the perforated interval. Wells which produced 100 per cent dry gas were temporarily shut-in if the gas could not be sold. Each unit was abandoned when the plant inlet rate fell below assumed plant economic limits. The sales gas rate for each unit was estimated using a gas purchase contract provided for increased rates under blowdown.

Hudson's Bay investigated various depletion schemes to determine optimum recovery, including:

- continued cycling with dry gas at the present voidage replacement ratio of 52 per cent,
- cycling with nitrogen at 100 per cent voidage replacement,
- poolwide blowdown,
- sequential blowdown, starting with Unit No. 1.

Hudson's Bay concluded that sequential blowdown of the pool with blowdown of Unit No. 1 commencing as soon as practical, to be optimum. This would allow Unit No. 1 to recover an additional 7.8 per cent recovery, relative to continued cycling, of which a certain portion is due to a reduction in migration out of the unit.

Views of Chevron

Chevron stated that its reservoir studies generally confirmed Hudson's Bay's predicted levels of recovery and that blowdown starting now was the best method to achieve maximum recovery from the Unit No. 1.

Views of the Board

The Board accepts that blowdown of Unit No. 1 should have the effect of increasing the rate of pressure decline in the northern end of the pool, thus reducing the amount of gas entrapped. The Board believes that only the net energy recovery gain, excluding the effects of migration, should be considered in evaluating the merits of blowdown over continued cycling. Using the results of Hudson's Bay's prediction cases the Board determined the net energy gain to be no more than 3 per cent of the Unit No. 1 energy in place. Though modest, it is sufficient to allow commencement of blowdown provided that potential adverse recovery affects on the cycling operations in Units No. 2 and 3 are minimized.

5 AVOIDING POSSIBLE ADVERSE EFFECTS OF BLOWDOWN OF UNIT NO. 1 ON UNITS NO. 2 AND 3

Views of Hudson's Bay

Hudson's Bay's proposed blowdown rate for Unit No. 1 would result in an average daily sales gas rate in the neighbourhood of 2.8×10^6 m^3 in 1980 compared to the current daily sales gas rate under continued cycling of about 0.58×10^6 m^3.

Hudson's Bay believed that the optimal time to commence blowdown was after approximately 60 per cent of the wet gas had been cycled, which would occur at about the end of 1979 in Unit No. 1. This was not based on a rigorous analysis, but rather on the general view that there would be sufficient dry gas in the reservoir to reduce retrograde condensation, and that wet gas production would decline rapidly from that point onward.

Although Hudson's Bay believed that the recovery from the other units in the pool would not be affected by blowdown of Unit No. 1, it agreed that curtailed rates of blowdown could be applied if found necessary.

Hudson's Bay acknowledged that there is no provision for blowdown in the gas purchase contracts for Unit No. 1. Therefore it is faced with other means of disposing of the additional residue gas. Hudson's Bay advised that Unit No. 1 is presently negotiating with Alberta and Southern for additional take of gas. If these negotiations are not successful, Unit No. 1 would attempt to negotiate a gas banking scheme with Units No. 2 and 3.

Hudson's Bay believed that storage of Kaybob Unit No. 1 residue gas in another reservoir was not feasible because of lack of appropriate and economical storage facilities. Similarly the possibility of Unit No. 1 owners making room for Kaybob gas in existing contracts in other fields was not practical because of the different ownership, different purchasers and drainage problems.

Views of Chevron

Chevron suggested that blowdown of Units No. 2 and 3 should be studied further but that it did not envision that commencement of blowdown in Unit No. 1 would have any significant recovery impact on the timing of blowdown for Units No. 2 and 3.

Views of Alberta and Southern

Alberta and Southern, the sole gas purchaser from Unit No. 1, estimated that under the existing contracts, its maximum take from Unit No. 1 would be approximately 0.58×10^6 m^3/d.

Alberta and Southern pointed out that in the last two contract years it had paid out one hundred million dollars to gas producers in the province of Alberta for gas that it was unable to take under existing take-or-pay purchase contracts. Increasing contractual commitments from Unit No. 1 would further aggravate this prepayment condition and as a result, Alberta and Southern would not favour such a proposal.

Views of Consolidated and TransCanada

Consolidated and TransCanada, gas purchasers from Units No. 2 and 3, stated that they encouraged and supported any operation which would result in the maximum recovery of hydrocarbons from the pool. However, they would not approve of any proposals which would require Consolidated to accept delivery of non-contracted gas.

Views of Trunk Line

Trunk Line stated that it would be possible to construct additional pipeline capacity for the blowdown of gas from Unit No. 1 during the spring of 1980 because a contractor would be operating in the area. However, to meet such a construction schedule, the necessary pipeline permit and authorizations would have to be received quickly.

Views of the Board

The Board believes that unrestricted blowdown of Unit No. 1 could have potential adverse effects on the cycling operations in Units No. 2 and 3. To avoid such effects, the Board believes that the production rate of Unit No. 1 should not be allowed to exceed 3.5×10^6 m^3/d. Also to avoid direct adverse effect on Unit No. 2 cycling operations, the Board believes that wells at the southern end of Unit No. 1 should not be produced during the early stage of blowdown.

The Board understands that marketing arrangements for the increased rate of sales gas from Unit No. 1 are being pursued by the unit owners.

6 DECISION

1. The Board approves the scheme for cessation of injection of residue gas and commencement of blowdown in the Kaybob South Beaverhill Lake Gas Unit No. 1, subject to the following conditions and those other terms and conditions which are specified in the attached Form of Approval:

(a) total raw gas production shall not exceed 3.5×10^6 m^3/d determined on a yearly average,

(b) wells 8-3-61-19 W5M and 15-3-61-19 W5M shall not be produced until such appropriate time in the future when an application to place them on production is approved by the Board,

(c) wells are to be operated in accordance with good production practice to minimize water coning and promote maximum recovery from the reservoir.

2. Before blowdown of Unit No. 1 commences, the operator shall advise the Board of the rate of take of residue gas that has been arranged and shall satisfy the Board that such rates are adequate for the effective implementation of the scheme.

DATED at Calgary, Alberta, on 27 June 1980.

ENERGY RESOURCES CONSERVATION BOARD

GJ DeSorcy

G. J. DeSorcy
Vice Chairman

N. Strom
Board Member

J. A. Bray
Acting Board Member

FORM OF APPROVAL

THE PROVINCE OF ALBERTA

THE OIL AND GAS CONSERVATION ACT

ENERGY RESOURCES CONSERVATION BOARD

IN THE MATTER of a scheme of Hudson's Bay Oil and Gas Company for cessation of injection of residue gas and commencement of blowdown in the Kaybob South Beaverhill Lake Gas Unit No. 1

APPROVAL NO. 3106

WHEREAS, the Oil and Gas Conservation Board by Approval No. 995, and its subsequent amendments A through K, approved a scheme by Hudson's Bay Oil and Gas Company Limited for the cycling of gas produced from Kaybob South Beaverhill Lake Gas Unit No. 1; and

WHEREAS, the Energy Resources Conservation Board is prepared to grant an application by Hudson's Bay Oil and Gas Company Limited for cessation of injection of residue gas and commencement of blowdown in Kaybob South Beaverhill Lake Gas Unit No. 1, subject to the terms and conditions herein contained; and

WHEREAS it is desirable that a new approval be issued to replace Approval No. 995.

THEREFORE, the Energy Resources Conservation Board, pursuant to The Oil and Gas Conservation Act, being chapter 267 of the Revised Statutes of Alberta, 1970, hereby order as follows:

1. The scheme of Hudson's Bay Oil and Gas Company Limited, (hereinafter called "the Operator") for the cessation of injection of residue gas and commencement of blowdown in the Kaybob South Beaverhill Lake Gas Unit No. 1 (hereinafter called "Unit No. 1"), as such scheme is described in an application by the Operator to the Board dated August 8, 1979, and supplementary material marked as exhibits and evidence given at a hearing held by the Board on February 5, 1980, is approved, subject to the terms and conditions herein contained.

2. The effective date of the approval shall be specified when the Operator satisfies the Board that a sufficient rate of residue gas disposition has been arranged to provide for effective implementation of the blowdown scheme.

3. Total raw gas production from the Kaybob South Beaverhill Lake Gas Unit No. 1 shall not exceed 3.5×10^6 cubic metres per day.

4. No production shall be taken from the wells Mobil Kaybob S 8-3-61-19 W5M and HB BL Gas Unit 1 Kaybob S 15-3-61-19 W5M.

5. Residue gas may continue to be injected into the wells HB BL Gas Unit Kaybob S 8-3-61-19 and HB BL Gas Unit 1 Kaybob S 9-19-61-19 principally for purposes of plant load levelling.

6. Gas produced from the unit shall be processed in accordance with Approval No. 2194.

7. Wells are to be operated in accordance with good production practice to minimize water coning and promote maximum recovery from the reservoir.

8. The Operator shall submit to the Board an annual report on the overall progress of the blowdown scheme which shall contain:

   (a) a description of pertinent reservoir and well performance trends and the projected annual program for optimizing gas recovery,

(b) calculations of the pressure declines corresponding with the net withdrawals and water influx from the aquifer during each month,

(c) an outline of any modifications in the details of the blowdown scheme made within the scheme as approved, and

(d) such other pertinent information as the Operator considers necessary to evaluate adequately the progress, performance and efficacy of the blowdown scheme.

9. The Operator shall take pressure and gas water interface surveys agreed upon with the Board staff.

10. The Operator shall report to the Board any detrimental effects that may be attributable to the operation of the blowdown scheme.

11. Board Approval No. 995 is hereby rescinded.

12. The Board may at any time vary the terms and conditions hereof or may suspend or revoke this approval, if in its opinion, circumstances so warrant.

MADE at the City of Calgary, in the Province of Alberta, this ___ day of __________.

ENERGY RESOURCES CONSERVATION BOARD

AL.1.143

ENERGY RESOURCES CONSERVATION BOARD
Calgary, Alberta

TOWN OF SUNDRE
RELOCATION OF A PIPELINE

Decision 80-10
Application 800359

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1 INTRODUCTION

1.1 The Application

Pursuant to section 34 of The Pipeline Act, 1975, the Town of Sundre applied to have the Board order the relocation of a pipeline owned by The Alberta Gas Trunk Line Company Limited from its present location to a new location parallelling the western boundaries of sections 33-32-5 W5M and 4-33-5 W5M, and the southern boundary of section 33-32-5 W5M, (see Figure 1).

Diameter of the pipeline is 914 mm and the licensed operating pressure is 8453 kPa.

The Town's application indicated that the proposed new Foothills pipeline intended, in part, to follow the existing AGTL pipeline route through the Town, and that the Town was opposed to this route for a number of reasons. Subsequently, the Town filed an appeal with the Northern Pipeline Agency on 13 March 1980, and made representation to the Agency at a hearing held on 1 May 1980.

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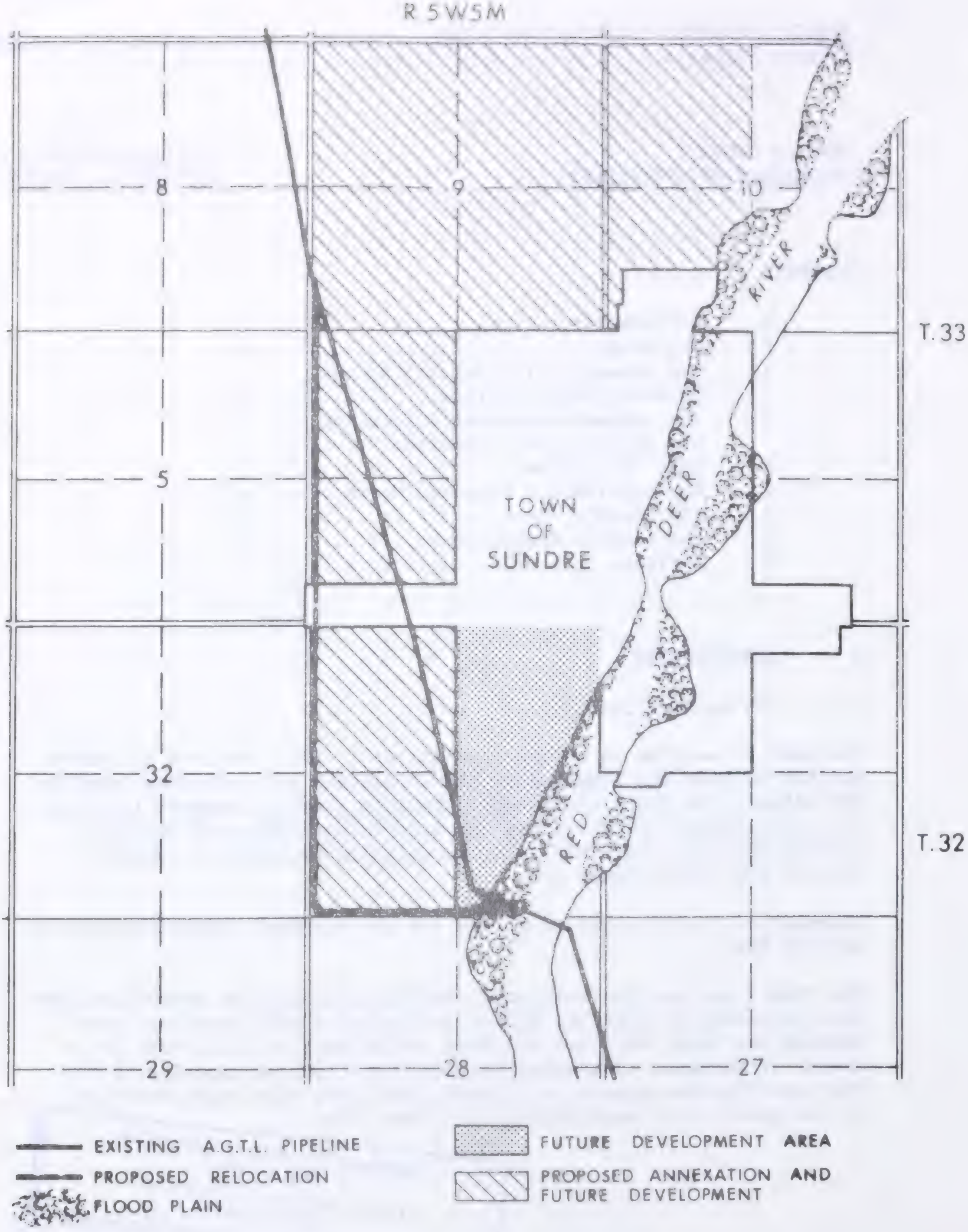


FIGURE 1 SUNDRE AREA

1.2 The Hearing

A public hearing of the application was held before the Energy Resources Conservation Board (Board) on 11 June 1980 in Sundre, Alberta, with C. J. Goodman, P.Eng., N. Strom, P.Eng., and L. A. Bellows, P.Eng., sitting.

THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations used in Report)	Witnesses
The Town of Sundre (Town) W. Phillips	P. D. Newman, MRTPI, MCIP H. Doering
The Alberta Gas Trunk Line Company Limited (AGTL) F. R. Foran	C. D. Richards, P.Eng. F. C. Hagedorn, P.Eng. W. Thompson, P. Eng. D. W. Levins R. Scheffer, P.Eng.
EMA Holdings Ltd. (EMA Holdings) J. Morgan	
Alberta and Southern Gas Co. Ltd. (A & S) T. R. Benson	
A. P. Newall A. P. Newall	
Energy Resources Conservation Board staff C. J. C. Page E. G. Fox, P.Eng. R. J. Allman, P.Eng	

1.3 The Notice of Hearing

Following an objection by Mr. Newall that he was not properly notified of the Board hearing, the Board solicitor stated that Notice of Hearing was publicly advertised in The Calgary Albertan, The Calgary Herald, and The Sundre Roundup on 28 May 1980. In addition, all interested landowners, pipeline operators, and government agencies had received a copy of the Notice by mail. Mr. Newall was one of the landowners on the mailing list, and his copy had been sent to his Sundre address.

2 THE ISSUES

The Board considers the principal issues of this application to be

- The merits of retaining the existing AGTL pipeline, or of relocating it to a new route.
- The allocation of costs if the pipeline is relocated.
- The suitability of the applicant's proposed new route.

3 THE ARGUMENTS FOR RELOCATING THE EXISTING AGTL PIPELINE

3.1 The Applicant

The Town contended that the present pipeline location would adversely affect orderly development under its annexation plans, and would result in restrictions to planned residential and industrial development. It believed such restrictions would cause land-use classification problems and thus preclude optimum use of property within the proposed Town limits.

The Town maintained that the existing AGTL right of way would create an undesirable utility corridor and buffer strip, resulting in the inefficient use of prime land due to partial severance. Problems could arise with regard to servicing areas to the west of the pipeline, and the result could be increased servicing costs. Added expense could also be incurred by the Town and developers in planning and designing subdivisions around the existing line; and concern was expressed with probable changes and inconvenience when the pipeline was upgraded in the future.

Without elaborating, the Town claimed that there would be added danger to residents living in close proximity to the pipeline.

3.2 EMA Holdings Ltd.

EMA Holdings contended that a part of its holding in SE¼ 33-32-5 W5M would be more or less isolated if the AGTL pipeline remained in its present location, and that the cost of servicing the isolated part could be prohibitive. EMA Holdings stated that it had acquired title to the land approximately three years ago for the purpose of development, and that it was aware of the existence of the AGTL pipeline at that time.

Regarding the current status of the EMA Holdings land, it was stated that a firm of consulting engineers has been engaged to draw up a prospectus on this property.

4 THE ARGUMENTS AGAINST RELOCATING THE EXISTING AGTL PIPELINE

4.1 The Alberta Gas Trunk Line Company Limited

AGTL stated that it could see no demonstrated need for moving its pipeline, and that the future subdivision plans of the Town could accommodate the pipeline right of way with no detrimental effects on the overall plan. It said that in general, pipelines have been successfully incorporated into subdivisions in the past, and it saw no difference in the pending plans of the Town. The pipeline right of way could be used as a buffer zone between residential and industrial areas, and the Draft General Municipal Plan prepared by the Red Deer Regional Planning Commission showed a logical and intelligent use of the existing pipeline easement as a buffer zone between developing areas. AGTL stated that it would, in co-operation with a developer, adjust the level and upgrade its existing pipeline in response to a demonstrated need.

Respecting the costs of servicing lands to the west of the existing pipeline, if and when those lands are subdivided for development, AGTL claimed that the incremental costs of servicing such facilities would be minimal.

AGTL contended that owing to the uncertainty of land development west of its pipeline, it would not be in the public interest to incur the large capital outlays needed to move the pipeline. AGTL testified that Foothills Pipeline (Alta.) Ltd. had been successful in negotiating 87 per cent of the pipeline easements through the whole of the area under discussion. This, in AGTL's view, was positive evidence of landowner acceptance of the existing pipeline route, notwithstanding the two exceptions who had not yet signed easements: the Town of Sundre and EMA Holdings Ltd.

4.2 Mr. A. P. Newall

Mr. Newall stated that he had completed the agreement for the Foothills pipeline route to be alongside the existing AGTL line and he was in accord with the location as it pertained to his property. He believed that the present pipeline route prejudiced his land to a much lesser degree than the new route proposed by the Town.

5 COST ALLOCATION

5.1 The Applicant

The Town adopted the position that it should not be held responsible for any portion of the relocation costs, but if such were not the case and it was ordered to carry the costs, it would have to do so by a debenture amortized out of pipeline tax revenues. In response to an undertaking given at the hearing, the Town advised the Board that it would not be prepared to contribute to the cost of relocation.

Commenting on actual costs involved in relocating the AGTL line, the Town reasoned that the combination of a relocation now with the proposed Foothills pipeline would result in a net cost benefit in the order of $270,000. The savings would come about by utilizing the contractor from the Foothills pipeline and avoiding the future costs of upgrading the existing AGTL pipeline.

5.2 Alberta and Southern Gas Co. Ltd.

A & S noted that, in a contract between it and the Town of Sundre, the Town was obligated to pay the costs associated with the pipeline and meter facilities necessary to accept gas from the AGTL line and bring it to the Town for distribution. A & S believed that the contract would apply equally to any new facilities required by a relocation of the AGTL pipeline, and that A & S should not be liable for any costs incurred.

5.3 The Alberta Gas Trunk Line Company Limited

ACTL adopted the position that if and when encroachment around its existing pipeline occurred the line would be upgraded to conform with applicable CSA standards, and it would pay the full cost of upgrading at that time. The company said it was prepared to fully co-operate with the Town to minimize the effect of the existing right of way in future subdivision plans, but that it was categorically against relocation, given the fact that the Town's plans for growth were preliminary in nature at this time and the timing was uncertain.

AGTL submitted evidence to show that the estimated additional cost of relocating the pipeline at this time compared to upgrading would be in the order of $1,000,000.

6 THE APPLICANT'S PROPOSED ROUTE

6.1 The Applicant

The Town presented a number of arguments in favour of its proposed route to the west, one of which was the need for a buffer strip between the proposed new Highway 22 and the Town. It voiced the opinion that a pipeline right of way adjacent to the highway would serve such a purpose, and would eliminate the need for providing an additional buffer. In effect it would create a utility corridor along the west side of town, comprising the highway and two pipelines.

In the same vein, the Town argued that commercial development along Highway 27 would be less affected by a pipeline relocation to the west than it would be by the existing route, and that wide gaps in prime industrial land classed as "highway commercial" would not be created. The Town also stated that in its view a relocation of the AGTL line now, combined with the new Foothills pipeline, would have the least effect on the Town's residents, both now and in the future. It maintained that considerable savings and benefits could accrue to both AGTL and the Town as a result of such a move, citing as examples the fact that the same contractor for the Foothills pipeline could be used to relocate the AGTL line, the higher costs for eventual upgrading of the existing line could be avoided, and that the Town would still retain tax benefits from both pipelines in their new location.

Regarding the effect of re-routing of the pipelines on landowners to the south, the Town contended that a north-south and east-west configuration would be less disruptive to land usage and future planning than the existing diagonal route across the same lands.

The Town stated positively that only one route should be followed by both the AGTL and Foothills pipelines.

6.2 The Alberta Gas Trunk Line Company Limited

In defense of its arguments against relocation, AGTL pointed out that the proposed new route along Highway 22 might not be the optimum location, both from an engineering or future planning standpoint since the location had not been chosen, investigated or designed by the company, or by any knowledgeable pipeline consultant. Also similar problems of planning and development could resurface later if the Town expanded to the west beyond Highway 22. AGTL indicated that commercial development along Highway 22 to the west might be made more difficult and less productive taking into account the effect of setback distances between the highway and the two pipeline rights of way.

AGTL also expected that the Town's proposed route might require an adjustment to the north at the river crossing, since a practical tie-in location was open to question. This in turn could lead to potential planning problems with EMA Holdings.

6.3 Mr. A. P. Newall

Mr. Newall believed that the Town's proposed route had a number of shortcomings, most of them dealing with the effect on present landowners. He claimed that a number of buildings and residences would have to be removed in order to accommodate the pipeline rights of way, and cited himself, Mr. MacDonnell and Mr. Howton as being directly affected. He also described how his property could be "boxed in" by the proposed route, and how this would severely affect his own future development plans for his property.

7 THE BOARD'S VIEWS

The Board notes the desire of all participants to have the AGTL and Foothills lines placed in adjacent rights of way. This proceeding deals with the AGTL route in the light of that general desire.

The Board notes from the evidence presented that the timing and pace of the Town's proposed development is still quite uncertain, and therefore the need for upgrading the existing AGTL line is indeterminate. In the opinion of the Board, upgrading of the existing AGTL pipeline does not appear to be warranted at this time, but if or when it is, the Board notes from AGTL's testimony that the company is prepared to pay the upgrading costs and to co-operate with developers. This would effectively relieve the Town of any major expenditures in this regard.

The Draft General Municipal Plan, for development expected over the next ten or more years, appears to have dealt with the constraints of the existing pipeline, and to have made provision for the Town to expand beyond Highway 22 to the west. The plan shows the existing AGTL right of way incorporated as a buffer zone between residential and commercial areas, and this appears to be a logical use of the easement. There would be a cost associated with this but in the Board's view it would be a manageable cost, and considerably less than the cost of moving the existing facility.

The Board believes that the Town's proposed route might not be an optimum location particularly having regard for highway-to-pipeline set back requirements.

8 THE BOARD'S CONCLUSIONS

The Board has not identified any compelling reasons to move the existing AGTL pipeline.

The move proposed is not in the broad public interest, cannot be strongly supported from the standpoint of safety, costs or urban planning and, given the uncertainties of future development, might be of little benefit to the Town.

The cost of any required future upgrading of presently existing facilities should be borne by AGTL. Other cost allocations for facilities do not arise in connection with these proceedings.

9 DECISION

The Board denies the application by the Town of Sundre, pursuant to section 34 of The Pipeline Act, 1975, for the relocation of a pipeline owned by The Alberta Gas Trunk Line Company Limited.

ISSUED at Calgary, Alberta, on 27 June 1980.

ENERGY RESOURCES CONSERVATION BOARD

C. J. Goodman

C. J. Goodman, P.Eng.
Board Member

N. A. Strom, P.Eng.
Board Member

L. A. Bellows, P.Eng.
Acting Board Member

CANADIANA
JUL 31 1980

ENERGY RESOURCES CONSERVATION BOARD
Calgary Alberta

KNIGHT COMPRESSOR STATION AND EDSON MAIN PIPELINE LOOPING - DECISION ON AGTL's APPLICATION

Decision 80-11
Applications 800207, 800248

1 INTRODUCTION

1.1 The Applications

On 21 March 1980, The Alberta Gas Trunk Line Company Limited (AGTL) applied to the Energy Resources Conservation Board (Application 800207) for a permit to construct a 9000-kW addition to AGTL's existing Knight compressor station in the northeast quarter of section 28, township 57, range 17, west of the 5th Meridian (see map on page 2).

On 13 June 1980, AGTL applied (Application 800248) for a permit to construct 161.3 km of 1067-mm pipeline that would loop the Edson main natural-gas pipeline in three sections. These sections are:

- the 62.8-km Clearwater loop from SW¼ 20-43-12 W5M to NE¼ 10-38-09 W5M

- the 56.7-km Nordegg loop from NW¼ 23-49-16 W5M to SW¼ 27-44-13 W5M

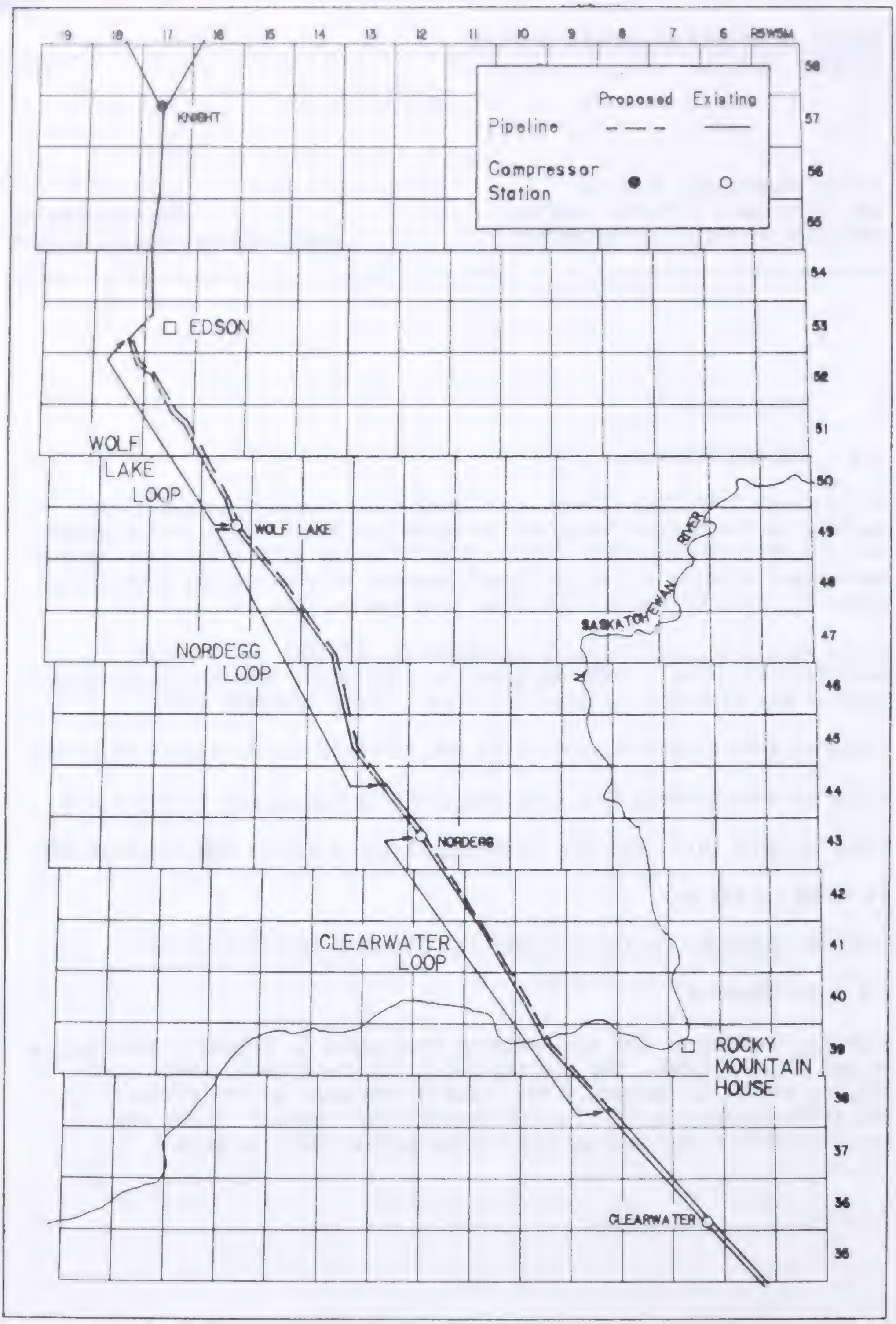
- the 41.8-km Wolf Lake loop from SE¼ 11-53-18 W5M to NW¼ 23-49-16 W5M

as shown on the map.

Both applications were made under The Pipeline Act, 1975.

1.2 The Hearing

A public hearing of the applications took place in Calgary, Alberta, on 24 and 25 June 1980. The hearing panel comprised Board members V. Millard and C. J. Goodman, P.Eng.; and G. Chelmick of the Public Utilities Board, appointed as an acting Board member. Those who participated at the hearing are listed in the table on page 3.



PROPOSED KNIGHT COMPRESSOR ADDITION AND EDSON MAIN PIPELINE LOOP

THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations used in Report)	Witnesses
The Alberta Gas Trunk Line Company Limited (AGTL, the applicant) J. Hopwood, Q.C.	Dr. G. R. Berard, P.Eng. P. S. Anderson, P.Eng. V. B. Kromand, P.Eng. D. G. Olafson, P.Eng. R. C. Hesje, P.Eng.
Alberta & Southern Gas Co. Ltd. T. R. Benson	
Canadian Hunter Exploration Ltd. J. G. Schissel, P.Eng.	
Independent Petroleum Association of Canada (IPAC) A. E. Potter, P.Eng.	
Pan-Alberta Gas Ltd. S. G. Trueman	
ProGas Limited G. M. Chernoff, P.Eng.	
TransCanada Pipelines Ltd. E. W. H. Mallabone	R. T. Liddle, P.Eng. D. C. Lee, P.Eng.
Energy Resources Conservation Board staff C. J. C. Page E. G. Fox, P.Eng. G. C. Dunn, P.Eng.	

1.3 The Issues

The Board considers the issues to be the need for and suitability of both the compressor station and the mainline looping.

2 COMPRESSOR STATION ADDITION

The Evidence

AGTL contended that the additional compressor capacity was required in order to transport the volumes of gas its shippers forecast would be tendered during the following four years. Since part of the gas supply now entering AGTL's western Alberta pipeline system is destined for markets served by its eastern system, and since the western has a lower operating pressure than the eastern AGTL submitted that there was no alternative but to provide additional compression at Knight, the compressor station linking the two systems.

In addition, AGTL explained that the present pipeline capacity had curtailed the extent to which some producers could obtain their fair share of the market, resulting in some disproportionate production during the current (1979-80) gas year.

Finally, AGTL presented information showing that one of the two adddi-tional compressor units would be needed to transport design volumes during the 1980-81 gas year, and the second as a standby. By the summer of 1981 both would be needed to transport design volumes.

None of the interveners disputed AGTL's data, nor did any dispute the need for the additional compression.

The Board's View

The Board has reviewed the available information, which clearly indicates that more compression power will be required during the 1980-81 gas year to move the forecast volumes and to ensure reliable service. The Board recognizes that no alternative to compression exists, and that the size of the facilities applied for represents reasonable and prudent planning.

3 EDSON MAINLINE LOOP

3.1 The Need

The Evidence

The applicant stated that the pipeline loop applied for was needed to transport the gas that shippers forecast would be delivered during the next four years. In response to questioning, AGTL indicated that some 60 per cent of that gas was intended for export markets, and the remainder for Canadian markets.

AGTL stated that full authorization for the movement of gas to export markets had not been obtained as yet, but it expected that such licences would commence on 1 November 1981. It contended, however, that because of winter construction constraints, approval for the pipeline loop was necessary now in order for the applicant to deliver the design volumes by 1 November 1981. If it were unable to deliver gas at that time, export sales could be lost and Alberta producers could suffer a loss of income.

In the case of Canadian markets, AGTL showed that the forecast increase in supply considerably exceeded that of demand. However, it explained this apparent discrepancy as follows:

(a) Some of the gas flowing through the applied-for pipeline would compensate for declining production and delivery from older pools feeding other parts of the system.

(b) The purchasers desire to honour contractual commitments, entered into with producers in northwestern Alberta, ensuring equitable access to the total market for producers in the province.

The Board's View

On the basis of the evidence submitted by the applicant, the Board is satisfied that the need for these additional facilities does exist, and that the timing of construction is important. The Board notes that none of the interveners disputed the need for additional pipeline capacity.

3.2 Suitability

Pipe Size

AGTL said it had considered several combined pipeline and compression alternatives before selecting the proposed facility. It submitted details of five alternatives, which considered both 1067- and 1219-mm pipe size plus additional versus no additional compression at the Clearwater station. The proposed alternative would result in a cumulative present-value cost of service somewhat higher than for the two alternatives that assumed a 1219-mm pipe size.

In support of this position, the applicant referred to uncertainties respecting the volume and timing of forecast incremental exports, and to its having been required to place an early order for pipe in order to meet its scheduled construction program. The 1067-mm size was both more available and more easily deployed elsewhere in the system if necessary.

Route

In response to questioning from IPAC, AGTL said it had not considered the development of a new pipeline to the west of the existing line as an alternative to the looping program. It indicated that in its view the loop would be far superior because it would have less environmental impact and because the western alternative would require a long lead time for feasibility studies and design work. AGTL indicated that the area west of the existing line could be accommodated by the addition of lateral pipelines if necessary.

IPAC suggested that the applicant should have considered a new pipeline farther west, in order that developing reserves in those areas might more readily be served. However, IPAC conceded that if time is of the essence, then consideration of an alternative western route is precluded.

The Board's View

The Board has reviewed the evidence concerning the size of pipe proposed. It agrees with the applicant that if the forecasts of future deliveries materialize, the larger, 1219-mm size might be somewhat preferable, but also notes that none of the interveners spoke in favour of adopting the larger size. The Board recognizes the arguments presented by AGTL in favour of the smaller size, and accepts that the 1067-mm is a prudent choice.

The Board is satisfied that the route applied for would have minimal environmental impact. Also, no evidence was presented to suggest that a western route would have any advantage over the applied-for route. In the Board's view it is clear that a new, western route could not be selected and approved, and pipeline construction completed, in time for the forecast delivery dates. The Board therefore concludes that the route applied for is appropriate.

4 DECISION

On the basis of the evidence presented at the hearing, the Board is satisfied that the applied-for compression facilities and pipeline are necessary and suitable. Accordingly, the Board is prepared to grant both Application 800207 and Application 800248, and will refer the applications to the Ministers of the Environment and of Energy and Natural Resources for their approval with respect to matters of the environment.

DATED at Calgary, Alberta, on 24 July 1980.

ENERGY RESOURCES CONSERVATION BOARD

V. Millard
Chairman

C. J. Goodman

C. J. Goodman
Board Member

G. Chelmick
Acting Board Member

AL.1.148

ENERGY RESOURCES CONSERVATION BOARD
Calgary Alberta

DECISION ON AN APPLICATION OF SHELL CANADA LIMITED FOR AN INDUSTRIAL DEVELOPMENT PERMIT FOR A SYNTHETIC CRUDE OIL REFINERY

Decision 80-12
Application 800229

1 APPLICATION AND HEARING

Shell Canada Limited applied, pursuant to section 42, subsection (2) of The Oil and Gas Conservation Act, for an industrial development permit authorizing the use of synthetic crude oil, natural gas liquids, and gas to manufacture refinery products, benzene, n-hexane, propane, butanes, and pentanes plus in a new refinery to be constructed near Scotford, Alberta. The requested permit would authorize the annual use of up to 2.91 x 10^6 cubic metres (m^3) of synthetic crude oil, 0.197 x 10^6 m^3 of mixed natural gas liquids, and 272 x 10^6 m^3 of gas for a term of 20 years commencing with plant start-up in 1984.

A public hearing of the application took place in Edmonton, Alberta on 18 June 1980 with G. J. DeSorcy, P.Eng., V. E. Bohme, P.Eng., and F. J. Mink, P.Eng., sitting.

Participants at the hearing are listed in Table 1-1. The Fort Saskatchewan Chamber of Commerce intervened in support of the application. Chevron's intervention related to security of supply of Alberta pentanes plus and synthetic crude oil for the operation of its Burnaby, British Columbia refinery. The other interveners presented no evidence but appeared only for the purpose of cross-examination and argument.

2 CONSIDERATION OF THE APPLICATION

2.1 Matters of Broad Interest

Shell stated at the hearing that Husky Oil Operations Limited (Husky), a wholly-owned subsidiary of Husky Oil Limited, would be participating in the project by way of a 40 per cent equity in a joint venture with Shell concerning the production of all products except benzene and n-hexane. Shell would be the managing partner and responsible for all aspects of the construction and operation of the refinery. Shell stated that, once the details of the joint venture were formalized, it expected that it would be necessary to file an application to amend any permit issued to include Husky as a permittee.

TABLE 1-1 THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations Used in Report)	Witnesses
Shell Canada Limited (Shell) R. M. Curtis	J. Williams, P.Eng. of Husky Oil Operations Limited D. J. Taylor H. Blair P. T. Budzik, P.Eng. R. J. Lamarre, P.Eng. C. D. Pegg F. A. Munroe D. G. Colley, P.Eng. of Western Research and Development
Alberta Energy Company Limited J. Meheriuk, P.Eng.	
Chevron Standard Limited (Chevron) R. A. Pashelka	R. E. Gray, P.Eng.
Dome Petroleum Limited J. F. Scott	
Fort Saskatchewan Chamber of Commerce B. Middugh	
Gulf Canada Limited J. D. Anderson	
Hudson's Bay Oil and Gas Company Limited R. M. Perrin	
Imperial Oil Limited W. M. Samoil	
Turbo Resources Limited (Turbo) D. G. Hart	
Energy Resources Conservation Board staff M. J. Bruni J. D. Dilay, P.Eng. Dr. W. R. Towle	

Shell indicated that the refinery would be capable of processing only synthetic crude oil. It would have an initial capacity of some 8000 m^3 per day, and the design would permit expansion to 11 000 m^3 per day. Mixed natural gas liquids would be separated into propane, butanes, and pentanes plus. Aromatics would be extracted from certain of the refinery streams to be converted to benzene for use as a petrochemical feedstock. At the hearing, Shell announced a joint venture agreement with The Alberta Gas Trunk Line Company Limited (Trunk Line) to use the benzene production from the refinery and ethylene to manufacture styrene in Alberta. The refinery would also be designed to produce n-hexane for use in Alberta and elsewhere. Natural gas would be used in the refinery as fuel and in the manufacture of hydrogen for use in the process.

The refinery would upgrade, using the most up to date technology available, synthetic crude oil to motor gasoline, diesel and aviation fuel, and a semi-refined light oil stream for final processing in Shell's Vancouver refinery. The semi-refined stream, suitable as gasoline blending components, is expected to be shipped to Vancouver for final processing to remove contamination resulting from transporting the product using a pipeline which also handles crude oil.

Shell stated that it is undertaking an environmental impact study and is designing the refinery to comply with all provincial environmental guidelines and standards.

The Board believes that Shell's proposal meets the public interest with respect to the matters of efficient use of energy resources, economic viability, resource upgrading, environmental impact, financing, and Albertan and Canadian content.

2.2 Availability of Raw Materials

Shell indicated that this would be the first refinery in the world designed to process synthetic crude oil exclusively and would be able to use the full range of synthetic crude oil produced from the Alberta oil sands. The choice of refinery design was made by Shell on its assessment that future conventional crude oil supplies will decline while synthetic crude oil production will rise.

Shell stated that the current total capacity of the Suncor and Syncrude plants is 27 000 m^3 per day and should increase to 40 000 m^3 per day by 1988. Combined with planned and announced synthetic crude oil plants, total capacity by 1990 will be approximately 103 000 m^3 per day. Shell stated that as a customer of record it has a secure supply of 5400 m^3 per day of synthetic crude oil from Suncor and Syncrude. Another 2200 to 2400 m^3 per day of Syncrude production may be available to Shell through the Alberta Petroleum Marketing Commission. The proposed refinery does not require additional synthetic crude oil plants to secure sufficient feedstock. Shell stated that, since the refinery is designed to use synthetic crude oil only, it should be designated an essential user of this resource.

Disruptions in feedstock supply would be alleviated by storage facilities. At the plant site, an inventory of 40 000 m^3 of synthetic crude oil would be available if total plant production were interrupted. Shell stated that Alsands[1] is considering prebuilding its storage tanks which would increase the inventory of synthetic crude by 40 000 m^3. Shell stated that it would have first call on this feedstock.

The gas required for the plant would be purchased from Northwestern Utilities Limited, and Calgary Power Limited would supply the electrical requirements. Shell would supply 75 per cent of its natural gas liquid requirements, with the balance coming from other Alberta producers.

Chevron expressed concern over the security of supply of pentanes plus and synthetic crude oil for the operation of its Burnaby refinery. Chevron stated that its position regarding pentanes plus requirements was outlined to the Board in submissions respecting previous applications. Chevron stated that its Burnaby refinery is an essential user of synthetic crude oil, with potential requirements for up to 3200 m^3 per day. Chevron asked that the Board give due consideration to the adequacy of incremental western Canada synthetic crude oil supplies from 1984 to the projected start-up of planned oil sands projects.

The Board agrees that supplies of synthetic crude oil from Suncor and Syncrude would provide sufficient feedstock for the refinery. On the basis of the proposed storage capacity outlined, the Board is satisfied that Shell has taken responsible precautions against feedstock supply disruptions. Additional synthetic crude oil productive capacity would supplement feedstock supply and provide greater security against disruptions in supply. The Board is also satisfied that sufficient supplies of natural gas liquids and gas would be available for the proposed use. The Board notes that the refinery would be a net producer of pentanes plus.

With respect to Chevron's concern for feedstock for its Burnaby refinery, the Board does not have jurisdiction to deal with refinery operations outside Alberta. The Board does note, however, that upgrading of Alberta resources within Alberta is generally more in the Alberta public interest than if such upgrading were done outside the province.

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[1] Alsands, Fort McMurray Project. ERCB Report 79-H, December 1979.

2.3 Marketing

Shell expected to serve the traditional market area served by Edmonton refineries along with other western Canada markets surplus to the refinery capacities in British Columbia, Saskatchewan, and Manitoba, and adjacent areas of the Northwest Territories.

Demand for refined petroleum products from Alberta refineries in the traditional market area in 1980 was estimated to exceed existing capacity. If additional capacity were not installed, the historical economic orbit of Edmonton refineries was seen to decrease in order to ensure supply for Alberta. In the period 1978 to 1990, refined petroleum product demand was forecast to increase at an annual rate of 2.0 per cent for the traditional market area, 3.4 per cent for Alberta, and 0.7 per cent for Canada as a whole. Growth rates were expected to be lower in the 1980s than the previous decade with the product mix requiring higher quality streams.

Shell stated that light oil product demand from Alberta refineries in the traditional market area in 1980 (35.9×10^3 m^3 per day) was seen to already exceed capacity (34.98×10^3 m^3 per day).

Diesel and aviation fuels were forecast to account for most of the increases in demand with motor gasoline demand growing at a much slower rate in light of improving automobile efficiencies and conservation. In the period 1978 to 1990, total light oil demand in the traditional market area was forecast to increase at an annual rate of 2.1 per cent with an upward threshold of 2.6 per cent. Annual growth rates by area ranged from a high of 3.3 per cent in Alberta to a low of 0.3 per cent in Manitoba. Annual growth rates for light oil products in Alberta were estimated to be 5.7, 4.6, and 1.5 per cent for diesel fuels, aviation fuels, and motor gasoline, respectively.

In the period 1978 to 1990, the applicant estimated an average annual increase in Canadian benzene demand of 9.7 per cent, with the rate varying from 12.7 per cent in the period 1978 to 1985 to 5.1 per cent in the period 1985 to 1990. Expansions and debottlenecking of existing plants coupled with new larger plants coming on-stream in central Canada were seen to create substantial growth in production in the near term.

Demand for benzene in domestic and export markets was forecast to exceed productive capacity by the mid-1980s. Benzene production at the rate of 730 m^3 per stream day at Shell's proposed refinery would be used as a feedstock in a styrene facility proposed by Shell and Trunk Line.

The applicant proposed to produce n-hexane at the rate of 48 m^3 per day to match the Canadian demand growth rate. A shortfall of this solvent, which is used in the rapeseed oil processing industry, resulted in Canadian imports of 24 m^3 per day in 1978. The current Alberta market was assessed at 24 to 32 m^3 per day.

Recognizing that oil refineries in Alberta are currently operating at capacity to meet demands in the traditional market area, the Board notes that an increase in demand must be matched by an increase in capacity if this market is to continue to be served by indigenous refineries.

The Board believes that sustained economic activity in the traditional market area and particularly Alberta presents a need for additional growth in the production of a range of refined petroleum products. On the basis of a conservative forecast, the Board believes that refined petroleum product demand in the traditional market area will require additional refinery capacity at least as large as the applicant's proposed design capacity by 1985. This demand forecast is an upward revision of the Board's projected refined petroleum product requirements in Alberta as outlined in ERCB Report 78-I[2]. Greater than expected growth in the level of economic activity (particularly petrochemicals) and population combined with less energy conservation as a result of smaller increases in energy resource prices have created a demand for refined petroleum products at levels higher and earlier than previously forecast.

In light of the applicant's proposal to transport a semi-finished petroleum product stream to Vancouver, it is apparent that the traditional market area is expanding to include parts of British Columbia outside the Kootenay region. As a result, the need for additional refinery capacity in Alberta becomes more acute.

The Board believes that given the declining supply of conventional crude oil it is in the public interest that synthetic crude oil will be upgraded in Alberta. It recognizes that such industrial activity and associated technological innovations are essential in maintaining the viability of an oil and gas industry in the province. While the Board does not have before it an application to use benzene and ethylene to manufacture styrene, it notes Shell's announcement respecting such plans. It believes that such downstream upgrading would enhance the development of an integrated petrochemical industry in Alberta.

2.4 Economic Impact

During the construction period from late 1980 to 1984 which would incur some 5128 man-years of employment, expenditures were estimated at $609 million ($1980) of which 69 per cent or $420 million were estimated to be spent in Alberta. Using an income multiplier of 2.0, the total economic impact in Alberta would be some $840 million.

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[2] Energy Requirements in Alberta 1977-2006. ERCB Report 78-I, September 1978.

The applicant expected a tight construction labour supply, particularly, the provincial technical labour pool, and would rely on some labour from outside Alberta. The refinery and marketing terminal was expected to employ some 232 persons and an additional 100 related service personnel.

Operating costs over the life of the project were calculated to be $524 million ($1980) of which 86 per cent or $450 million would be expended in Alberta. Municipal and provincial taxes combined with re-investment of cash income would add $1.1 billion ($1980) to the Alberta economy.

Excluding feedstock costs, construction and operation of the proposed refinery and marketing terminal was estimated to add approximately $2 billion to the Alberta economy. Employing an income multiplier of 2.0, the total direct and indirect impact would be some $4 billion over the project life.

The Board agrees that the project will generate a positive economic impact on the Province of Alberta. However, the Board foresees a possible tight labour supply during the construction period which may require special liaison with the provincial government departments. A significant proportion of certain types of labourers may have to be secured from other parts of Canada.

2.5 Social Impact

The applicant expected most construction labour to come from Alberta and principally the Edmonton region. Busing as opposed to a construction camp was seen as a necessary arrangement in this instance. Thus, peak construction manpower of up to 2000 labourers during the latter half of 1983 was not expected to impact significantly on the region.

Using an employment multiplier of 3.13, the direct and indirect employment resulting from the operation of the plant was estimated at 732 jobs. Assuming a labour force participation rate approaching 50 per cent, the total incremental population would be some 1450 persons.

The applicant's evaluation of existing residences of employees already working in the area inferred that most refinery personnel would live in the Edmonton metropolitan region; particularly Fort Saskatchewan, Lamont, and Sherwood Park. With the exception of Lamont, the incremental community population impact was expected to be minor.

The Board accepts that the total incremental population associated with the construction and operation of the refinery and marketing terminal is minor compared to the regional population within commuting distance of the project. The refinery will contribute to the municipal economies of some small communities near the plant site but most of the direct and indirect impact will focus on Fort Saskatchewan and Edmonton. The Board does not believe that Lamont will be significantly impacted upon by the project.

3 FINDINGS AND DECISION

The Board finds that Shell's proposal represents an efficient use of energy resources, and that the proposed project is in the public interest of Alberta having regard for present and future availability of energy resources and for other matters. Accordingly, the Board is prepared, with the approval of the Lieutenant Governor in Council, to issue the requested permit to Shell. The permit would authorize the use of a maximum annual volume of 2.91×10^6 m^3 (18.3×10^6 barrels) of synthetic crude oil, 0.197×10^6 m^3 (1.24×10^6 barrels) of natural gas liquids, and 272×10^6 m^3 (9654×10^6 standard cubic feet) of natural gas as feedstock and fuel in the production of refinery products, propane, butanes, pentanes plus, benzene, and n-hexane in a refinery in the County of Strathcona for the period to 31 December 2003. The permit would be in the form shown in the Appendix to this report and would be subject to the terms and conditions contained therein and to any conditions imposed by the Lieutenant Governor in Council.

Dated at Calgary, Alberta this 20th day of August 1980.

ENERGY RESOURCES CONSERVATION BOARD

GJ DeSorcy

G. J. DeSorcy, P.Eng.
Vice Chairman

VE Bohme

V. E. Bohme, P.Eng.
Board Member

F mink

F. J. Mink, P.Eng.
Acting Board Member

IN THE MATTER of The Oil and Gas Conservation Act, being chapter 267 of the Revised Statutes of Alberta, 1970; and

IN THE MATTER of an industrial development permit authorizing the use within Alberta of synthetic crude oil, natural gas liquids and gas produced in Alberta in the production of refinery products, benzene, n-hexane, propane, butanes and pentanes plus

INDUSTRIAL DEVELOPMENT PERMIT NO. SC 80-1

WHEREAS Shell Canada Limited has applied to the Energy Resources Conservation Board for an industrial development permit, pursuant to section 42 of The Oil and Gas Conservation Act (the Act), authorizing the use of synthetic crude oil, natural gas liquids and gas produced in Alberta for the production of refinery products, benzene, n-hexane, propane, butanes and pentanes plus in Alberta; and

WHEREAS the Board upon inquiry into the application, is of the opinion that the granting of this industrial development permit for the use of synthetic crude oil, natural gas liquids and gas as raw material and fuel in the production of refinery products, benzene, n-hexane, propane, butanes and pentanes plus is in the public interest having regard to, among other considerations, the efficient use without waste of energy resources and the present and future availability of hydrocarbons in Alberta; and

WHEREAS the Lieutenant Governor in Council has given his approval by Order in Council, numbered O.C.   and dated   , authorizing the granting of the permit.

THEREFORE, the Energy Resources Conservation Board, pursuant to the provisions of section 42 of The Oil and Gas Conservation Act, being chapter 267 of the Revised Statutes of Alberta, 1970, hereby grants an industrial development permit to Shell Canada Limited (hereinafter called "the Permittee") authorizing the use of synthetic crude oil, natural gas liquids and gas as raw material and fuel in the production of refinery products, benzene, n-hexane, propane, butanes and pentanes plus subject to the regulations and orders made pursuant to the Act and to the terms and conditions prescribed in this permit as follows:

1. This permit is for the use in Alberta by the Permittee of synthetic crude oil and natural gas liquids as raw material and gas as fuel in the production of refinery products, benzene, n-hexane, propane, butanes and pentanes plus, generally as described in the application of the Permittee dated April 1, 1980.

2. The refinery shall be located in the North-east quarter of Section 30, the East half of Section 31, and all of Section 32, all in Township 55, Range 23, West of the 4th Meridian, and the South half of Section 5 and the South-east quarter of Section 6, all in Township 56, Range 21, West of the 4th Meridian.

3. Subject to the conformity by the Permittee with the terms and conditions hereof, this permit shall be for a term commencing on the date hereof and ending on December 31, 2003.

4. The quantity of synthetic crude oil, natural gas liquids and gas that may be used per calendar year in the industrial operation referred to herein shall not exceed

(a) 2.91 million cubic metres of synthetic crude oil,

(b) 197 thousand cubic metres of natural gas liquids,

(c) 272 million cubic metres of gas.

5. The quantities of gas for the purpose of this permit shall be on the basis of a gas free of water vapour and having a higher heating value of 37.4 megajoules per cubic metre.

6. All synthetic crude oil, natural gas liquids and gas used in producing refinery products, benzene, n-hexane, propane, butanes and pentanes plus pursuant to this permit shall be measured by or on behalf of the Permittee and shall be separately reported to the Board in a manner satisfactory to the Board.

7. The Permittee shall obtain the approval of the Board of any major changes in design of the refinery.

8. (1) The Permittee shall satisfy the Board prior to November 1, 1980, that arrangements for the financing of its proposed project have been completed, unless upon application by the Permittee a later date is stipulated by the Board.

(2) The Permittee shall satisfy the Board prior to November 1, 1980, that construction of its proposed project has commenced and that construction of the proposed facilities will continue in accordance with the schedule described in the application dated April 1, 1980, unless upon application by the Permittee, later dates are stipulated by the Board.

9. During the construction of the proposed project, the Permittee shall inform the Board, on a semi-annual basis, of the progress of construction.

10. The Permittee shall operate the refinery in a manner that results in

(a) the maximum practicably obtainable efficiency in the use of synthetic crude oil, natural gas liquids and gas for the manufacture of refinery products, benzene, n-hexane, propane, butanes and pentanes plus, and

(b) the maximum practical conservation of synthetic crude oil, natural gas liquids and gas.

11. The Permittee shall not

(a) assign this permit, or

(b) release from his control the operation of the plant, without consent in writing of the Board, which may, with the authorization of the Lieutenant Governor in Council, be given by the Board upon application therefor.

12. (1) Attached hereto as Appendix A and made part of this permit, is the Order of the Lieutenant Governor in Council authorizing the granting of this permit.

(2) This permit is subject to the terms and conditions, if any, prescribed by the Order of the Lieutenant Governor in Council set out in Appendix A.

13. Where it appears to the Board or the Lieutenant Governor in Council that the Permittee has contravened or failed to comply with any term or condition contained in this permit or any relevant statutes or regulations of Alberta,

(a) the Board shall review the permit and, with the approval of the Lieutenant Governor in Council, may cancel the said permit or take such other remedial measures as considered suitable by the Board and the Lieutenant Governor in Council in the circumstances, or

(b) the Lieutenant Governor in Council may amend, vary, add to or replace any terms or conditions contained in this permit.

14. Notwithstanding the provisions hereof, the Permittee shall comply with the provisions of any Act, regulation, order or direction governing the drilling for, production, conservation, gathering, transportation, processing, purchasing,

acquisition, sale, measurement, reporting, testing, supply or delivery of energy resources within the Province.

MADE at the City of Calgary, in the Province of Alberta, this day of

ENERGY RESOURCES CONSERVATION BOARD

G. J. DeSorcy
Vice Chairman

AL 1.148

ENERGY RESOURCES CONSERVATION BOARD
Calgary Alberta

DECISION ON AN APPLICATION OF TURBO RESOURCES LIMITED FOR AN INDUSTRIAL DEVELOPMENT PERMIT FOR A SOUTHERN ALBERTA REFINERY

Decision 80-13
Application 800249

1 APPLICATION AND HEARING

Turbo Resources Limited applied, pursuant to section 42, subsection (2) of The Oil and Gas Conservation Act, for an industrial development permit authorizing the use of crude oil, pentanes plus, and butanes as feedstock, and gas as fuel in a refinery/waste lubricating oil recycling facility to be constructed near Balzac, Alberta. The requested permit would authorize the annual use of 1.83×10^6 cubic metres (m^3) of crude oil and pentanes plus (including up to 0.4×10^6 m^3 of pentanes plus), up to 0.15×10^6 m^3 of butanes, and up to 34×10^6 m^3 of gas in the production of motor gasoline, aviation and diesel fuels, recycled lubricating oils, propane, butanes, sulphur, asphalt, and petroleum specialty products. The permit term requested was 20 years commencing with plant start-up in 1981.

A public hearing of the application took place in Calgary, Alberta on 25 June 1980 with G. J. DeSorcy, P.Eng., V. E. Bohme, P.Eng., and F. J. Mink, P.Eng., sitting.

Participants at the hearing are listed in Table 1-1. None of the interveners presented evidence but appeared only for the purpose of cross-examination and argument.

2 CONSIDERATION OF THE APPLICATION

2.1 Matters of Broad Interest

The proposed refinery would be built and operated by Turbo or a wholly-owned subsidiary. Turbo stated that although one or more partners may be involved in the ownership, success of the project was not contingent upon it obtaining a partner.

Turbo stated that it was one of the largest non-refining petroleum product marketers in Canada and that the proposed refinery would strengthen its security of supply to its marketing outlets. The company is currently developing a project management team which has refinery construction and operating experience. Refinery design was undertaken by UOP Process Division, a division of UOP Incorporated. Financing would be obtained from existing cash flow, and debt issue, along with a financial proposal which would cover the entire $140 million cost of the project.

TABLE 1-1 THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations used in Report)	Witnesses
Turbo Resources Limited (Turbo) D. G. Hart	R. M. Maxwell F. W. King, P.Eng. R. G. Woolley, P.Eng. T. I. McCann, P.Eng. D. Rogers J. Kanofsky, P.Eng., of UOP Incorporated
Alberta Energy Company Limited (AEC) J. Meheriuk, P.Eng.	
Chevron Standard Limited R. A. Pashelka	
Dome Petroleum Limited (Dome) L. Dolecki	
Gulf Canada Limited J. D. Anderson	
Hudson's Bay Oil and Gas Company Limited (HBOG) R. M. Perrin	
Imperial Oil Limited (Imperial) W. M. Samoil	
Shell Canada Limited (Shell) R. M. Curtis	
Energy Resources Conservation Board staff A. L. McLarty J. D. Dilay, P.Eng. G. R. Nadeau Dr. W. R. Towle	

The refinery would be developed in two phases to allow for the earliest possible start-up. Pentanes plus would make up 100 per cent of the feedstock requirements during the first 3 to 6 months of the initial phase to facilitate start-up of the new units. As further downstream units were added, the refinery would be capable of using light and medium crude oil, with or without pentanes plus. Upon completion of the first phase and the initial start-up, up to 3200 m^3 per day of light and medium crude oil would be processed. Upon completion of the second phase in 1983, the refinery would be capable of processing up to some 5000 m^3 per day of light, medium, and heavy crude oil, and pentanes plus. The refinery would feature a waste lubricating oil recycling unit using technology developed by Turbo.

Turbo stated that the refinery would meet all applicable provincial environmental standards. Sulphur would be recovered at the adjacent Petrogas Balzac gas processing plant. In addition, Turbo stated that it would be reprocessing environmentally hazardous waste lubricating oil, thus improving the provincial environment and conserving a valuable resource. Turbo requested the support of the provincial and municipal governments in waste oil collection and the abolition of waste oil for road dust control.

The Board is satisfied that Turbo's proposal meets the public interest in the matters of the efficient use of energy resources, Albertan and Canadian content, resource upgrading, economic viability, and decentralization of industry within the province. It is also satisfied that the project would be environmentally acceptable and would be required to meet Alberta Department of Environment standards. In particular, the Board notes that the waste lubricating oil recycling aspect of the project could have a significant positive environmental effect on a wide area of the province. Further, the Board believes that any social impact of the project would be minimal.

2.2 Availability of Raw Materials and Fuel

Turbo stated that the proposed refinery was designed with the flexibility to use crude oil or pentanes plus. Pentanes plus could make up 25 per cent of the feedstock requirements during the first phase of the project. However, pentanes plus would not be essential to the operation of the refinery after 1982. Turbo recognized the previously-approved use of pentanes plus as a feedstock for benzene production in Alberta, and accepts the priority for its use as outlined in ERCB Report 77-C[1] in case of supply shortages.

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[1] In the Matter of an Application of Alberta Energy Company Ltd., Hudson's Bay Oil and Gas Company Limited, Mitsubishi Petrochemical Company Limited and Mitsubishi Corporation and In the Matter of an Application of The Alberta Gas Trunk Line Company Limited, Dow Chemical of Canada, Limited and Alberta Gas Chemicals Ltd. Both Under Section 42 of The Oil and Gas Conservation Act. ERCB Report 77-C, February 1977.

Crude oil would be obtained from established and new fields in southeastern Alberta. Heavy crude oil requirements would be drawn mainly from southeastern Alberta and incrementally from more northerly areas. Gas requirements would be obtained from the local utility or from Turbo's own Alberta gas reserves.

With respect to its butanes requirements, Turbo stated that it was based on provision in the process design for alkylation of butylenes and/or propylenes with isobutane to very high octane gasoline blending stocks. Inclusion of alkylation in the process would depend on further assessment of butanes values and capital costs of the required equipment. Turbo's gas requirements also included volumes necessary with alkylation. The alternative to alkylation suggested by Turbo was polymerization of certain olefins to gasoline boiling range components for high octane blending stock and would result in a net sale of butanes from the refinery and lower gas requirements.

The Board believes that sufficient supplies of crude oil, butanes, and gas will be available to meet the requirements of the proposed refinery. With respect to pentanes plus, the Board believes that, having regard to its previous decision respecting authorization to use pentanes plus to manufacture benzene, and the volumes of pentanes plus required for that use in relation to the expected production of pentanes plus, if a permit were issued to Turbo, it should authorize firm volumes of pentanes plus for Turbo's use only until 1982. Consistent with other similar permits for refineries, authorization for pentanes plus use after 1982 should be conditional upon Turbo satisfying the Board each year that the volumes would be available to Turbo.

If a permit were issued, the Board would be prepared to include authorization to use the butanes and gas volumes requested for alkylation on the basis that Turbo would include it in the process design. Since the Board would consider polymerization to be a major process design change, it would expect Turbo to apply for an amendment to any permit issued to eliminate authorization to use butanes and reduce gas use authorization consistent with the requirements for polymerization.

2.3 Marketing Plans

Turbo submitted that all gasoline, diesel fuel, and lubricant products from its proposed refinery could be readily marketed through its existing marketing operations in Canada and noted that asphalt sales contracts are under discussion. Turbo expected to process some 1500 m^3 per day of pentanes plus and 1700 m^3 per day of light crude oil during the initial phase and to increase capacity to process a total of some 5000 m^3 per day of light, medium, and heavy crude oil, and pentanes plus during the second phase. The applicant noted that the gasoline and diesel fuel output from phase one would satisfy less than one-third of existing southern Alberta and southeastern British Columbia demand while the output from phase two would supply about 40 per cent of that regional demand.

and would be subject to the terms and conditions contained therein and to any conditions imposed by the Lieutenant Governor in Council.

Dated at Calgary, Alberta this 20th day of August 1980.

ENERGY RESOURCES CONSERVATION BOARD

G J DeSorcy

G. J. DeSorcy, P.Eng.
Vice Chairman

V E Bohme

V. E. Bohme, P.Eng.
Board Member

F J Mink

F. J. Mink, P.Eng.
Acting Board Member

and would be subject to the terms and conditions contained therein and to any conditions imposed by the Lieutenant Governor in Council.

Dated at Calgary, Alberta this 20th day of August 1980.

ENERGY RESOURCES CONSERVATION BOARD

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Vice Chairman

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V. E. Bohme, P.Eng.
Board Member

FJ Mink

F. J. Mink, P.Eng.
Acting Board Member

IN THE MATTER of The Oil and Gas Conservation Act, being chapter 267 of the Revised Statutes of Alberta, 1970; and

IN THE MATTER of an industrial development permit authorizing the use within Alberta of crude oil, pentanes plus, butanes and gas produced in Alberta in the production of refinery products and recycled lubricating oil

INDUSTRIAL DEVELOPMENT PERMIT NO. TR 80-1

WHEREAS Turbo Resources Limited has applied to the Energy Resources Conservation Board for an industrial development permit, pursuant to section 42 of The Oil and Gas Conservation Act (the Act), authorizing the use of crude oil, pentanes plus, butanes and gas produced in Alberta for the production of refinery products, and recycled lubricating oil in Alberta; and

WHEREAS the Board upon inquiry into the application, is of the opinion that the granting of this industrial development permit for the use of crude oil, pentanes plus and butanes as raw material and gas as fuel in the production of refinery products, and recycled lubricating oil is in the public interest having regard to among other considerations, the efficient use without waste of energy resources and the present and future availability of hydrocarbons in Alberta; and

WHEREAS the Lieutenant Governor in Council has given his approval by Order in Council, numbered O.C. and dated , authorizing the granting of the permit.

THEREFORE, the Energy Resources Conservation Board, pursuant to the provisions of section 42 of The Oil and Gas Conservation Act, being chapter 267 of the Revised Statutes of Alberta, 1970, hereby grants an industrial development permit to Turbo Resources Limited (hereinafter called "the Permittee") authorizing the use of crude oil, pentanes plus and butanes as raw material and gas as fuel in the production of refinery products, and recycled lubricating oil subject to the regulations and orders made pursuant to the Act and to the terms and conditions prescribed in this permit as follows:

1. This permit is for the use in Alberta by the Permittee of crude oil, pentanes plus and butanes as raw material and gas as fuel in the production of refinery products, and recycled lubricating oil generally as described in the application of the Permittee dated April 9, 1980.

2. The refinery shall be located in Section 1 of Township 26, Range 29, West of the 4th Meridian.

3. Subject to the conformity by the Permittee with the terms and conditions hereof, this permit shall be for a term commencing on the date hereof and ending on December 31, 2001.

4. (1) The quantity of crude oil, butanes and gas, and the quantity of pentanes plus that may be used in the industrial operation referred to herein shall not, subject to subclause (2), exceed in any of the following calendar years the maximum quantity prescribed for that year as follows:

Year	Crude Oil (10^6 cubic metres)	Pentanes Plus (10^6 cubic metres)	Butanes (10^6 cubic metres)	Gas (10^6 cubic metres)
1981	0.3	0.2	0.01	4
1982	1.5	0.6	0.06	12
1983	1.5	-	0.11	18
1984	1.83	-	0.15	24
1985	1.83	-	0.15	26
1986	1.83	-	0.15	28
1987	1.83	-	0.15	30
1988	1.83	-	0.15	30
1989	1.83	-	0.15	30
1990	1.83	-	0.15	30
1991	1.83	-	0.15	32
1992	1.83	-	0.15	32
1993	1.83	-	0.15	32
1994	1.83	-	0.15	32
1995	1.83	-	0.15	32
1996	1.83	-	0.15	34
1997	1.83	-	0.15	34
1998	1.83	-	0.15	34
1999	1.83	-	0.15	34
2000	1.83	-	0.15	34
2001	1.83	-	0.15	34

(2) For the period January 1, 1983 to December 31, 2001, the quantity of pentanes plus that may be used in the industrial operation referred to herein shall not exceed such annual quantity as may be stipulated by the Board, but not exceeding 0.4 million cubic metres per calendar year.

(3) The Permittee, prior to any stipulation being made by the Board, pursuant to subclause (2), shall file with the Board, a report in accordance with and respecting the matters set out in subclause (4).

(4) On or before October 1, 1982, and on or before October 1 in each year thereafter, during the term of this permit, the Permittee shall satisfy the Board with respect to the quantity of pentanes plus that will be available to the

Permittee in the next ensuing year for the manufacture of refinery products in the Permittee's industrial operation.

5. The quantities of gas for the purpose of this permit shall be on the basis of a gas free of water vapour and having a higher heating value of 37.4 megajoules per cubic metre.

6. All crude oil, pentanes plus, butanes and gas used in producing refinery products, and recycled lubricating oil, pursuant to this permit shall be measured by or on behalf of the Permittee and shall be separately reported to the Board in a manner satisfactory to the Board.

7. The Permittee shall obtain the approval of the Board of any major changes in design of the refinery.

8. (1) The Permittee shall satisfy the Board prior to November 1, 1980, that arrangements for the financing of its proposed project have been completed, unless upon application by the Permittee a later date is stipulated by the Board.

(2) The Permittee shall satisfy the Board prior to November 1, 1980, that construction of its proposed project has commenced and that construction of the proposed facilities will continue in accordance with the schedule described in the application dated April 9, 1980, unless upon application by the Permittee, later dates are stipulated by the Board.

9. During the construction of the proposed project, the Permittee shall inform the Board, on a semi-annual basis, of the progress of construction.

10. The Permittee shall operate the refinery in a manner that results in

(a) the maximum practicably obtainable efficiency in the use of crude oil, pentanes plus, butanes and gas for the manufacture of refinery products, and recycled lubricating oil, and

(b) the maximum practical conservation of crude oil, pentanes plus, butanes and gas.

11. The Permittee shall not

(a) assign this permit, or

(b) release from his control the operation of the plant,

without consent in writing of the Board, which may, with the authorization of the Lieutenant Governor in Council, be given by the Board upon application therefor.

12. (1) Attached hereto as Appendix A and made part of this permit, is the Order of the Lieutenant Governor in Council authorizing the granting of this permit.

(2) This permit is subject to the terms and conditions, if any, prescribed by the Order of the Lieutenant Governor in Council set out in Appendix A.

13. Where it appears to the Board or the Lieutenant Governor in Council that the Permittee has contravened or failed to comply with any term or condition contained in this permit or any relevant statutes or regulations of Alberta,

(a) the Board shall review the permit and, with the approval of the Lieutenant Governor in Council, may cancel the said permit or take such other remedial measures as considered suitable by the Board and the Lieutenant Governor in Council in the circumstances, or

(b) the Lieutenant Governor in Council may amend, vary, add to or replace any terms or conditions contained in this permit.

14. Notwithstanding the provisions hereof, the Permittee shall comply with the provisions of any Act, regulation, order or direction governing the drilling for, production, conservation, gathering, transportation, processing, purchasing, acquisition, sale, measurement, reporting, testing, supply or delivery of energy resources within the Province.

MADE at the City of Calgary, in the Province of Alberta, this day of

ENERGY RESOURCES CONSERVATION BOARD

G. J. DeSorcy
Vice Chairman

AL1.1.148

APR 7 1981

ENERGY RESOURCES CONSERVATION BOARD
Calgary Alberta

EDMONTON POWER
240-kV TRANSMISSION LINE
JASPER TERMINAL-NORTH CALDER

Decision 80-14
Application 800049

1 THE APPLICATION AND HEARING

Edmonton Power applied, pursuant to Sections 9, 11, 13 and 14 of The Hydro and Electric Energy Act, for a permit to construct and a licence to operate a 240-kV transmission line - designated as EP 930L - from Edmonton Power's Jasper Terminal Station to Calgary Power Ltd.'s North Calder substation.

Following publication of Notice, the Board received three interventions from affected landowners, and heard representations respecting the application at a public hearing in Edmonton on 8 July 1980, with N. Berkowitz, P.Eng. (Chairman), C. J. Goodman, P.Eng., and J. A. Bray, P.Eng., sitting.

Table 1 identifies the parties who appeared at the hearing. A submission by John Chesla was not spoken to.

TABLE 1 THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations used in Report)	Witnesses
Edmonton Power J. Franklin, Solicitor	A. Sadesky, P.Eng.
Mary Duke R. Davison, Solicitor	Mary Duke
T. L. Babie, et al	T. L. Babie G. Patrick
Energy Resources Conservation Board staff (Board Staff) M. J. Bruni, Board Solicitor J. F. Wilson, P.Eng. J. B. Cole	

2 FINDINGS AND DECISION

2.1 Findings

Having considered the application and representations respecting it, the Board finds as follows:

(a) the proposed 240-kV transmission line (EP 930L) is needed for reliable and secure supply of electric energy from the Jasper terminal station to northwest Edmonton; and

(b) the proposed route is appropriate provided that the right of way for the transmission line immediately abuts the buffer zone on the eastern side of the ring-road at points where the buffer zone parallels the ring-road.

2.2 Decision

Having regard for its responsibilities under The Hydro and Electric Energy Act, and for the reasons stated in this report, the Board grants the application subject to the terms and conditions set out in the Form of Permits and Form of Licences hereto attached as Appendix A.

2.3 Ministerial Approvals

Pursuant to Section 10 of The Hydro and Electric Energy Act, the Board has referred the application to the Minister of the Environment and the Minister of Energy and Natural Resources, and these ministers have given their approvals with respect to the environmental aspects of the application. The permits and licences issued by the Board are subject to such conditions as the Ministerial Approvals impose.

DATED at Calgary, Alberta on 14 August 1980.

ENERGY RESOURCES CONSERVATION BOARD

N. Berkowitz
Vice Chairman

C. J. Goodman

C. J. Goodman
Board Member

J. A. Bray
Acting Board Member

REASONS FOR THE DECISION

3 BACKGROUND AND DEFINITION OF ISSUES

3.1 Background

Edmonton Power's Jasper Terminal Station supplies power for loads in northwest Edmonton. In order to maintain reliable and economic service to this area in the event of an outage of either or both transmission lines feeding Jasper Terminal, Edmonton Power, by Application 800049, sought authorization to construct and operate a 240-kV transmission line to link its Jasper Terminal Station to Calgary Power's North Calder Substation some five miles to the north.

3.2 Definition of Issues

The two issues raised by the application are:

(a) the need for the proposed transmission facilities; and

(b) the acceptability of the proposed transmission line route.

4 THE NEED FOR THE PROPOSED TRANSMISSION FACILITIES

4.1 Views of Edmonton Power

The applicant submitted that the proposed line is needed in order

(a) to provide improved power supply and service reliability to northwest Edmonton in the event of transmission outages; and

(b) to allow more efficient use of existing generating facilities, with concomitant savings that would accrue from lower demands upon the natural gas-fuelled Rossdale plant.

Edmonton Power stated that without 930L in service by late 1980, its generating facilities could not be operated most economically without exposing the Jasper Terminal Substation to unacceptable conditions if the westerly 904L circuit, which provides the main 240-kV supply from Wabamun, is lost.

Edmonton Power also claimed that the proposed 930L would allow more efficient distribution of loading on existing 240-kV circuits since it would complete a high-voltage transmission ring around the City of Edmonton, and provide for a second circuit if that were later required to meet greater electric energy demands than are presently foreseen in the northwestern part of the city.

4.2 Views of the Board

The Board notes that the interveners did not comment on the need for the proposed line. The Board finds Edmonton Power's load forecast for the Jasper Terminal Substation presents a reasonable projection, and agrees that Edmonton Power could not satisfactorily service the west Edmonton 240-kV system without the proposed 930L, unless it operated the Rossdale plant at higher levels with correspondingly reduced output from other, more efficient generating units. This would increase Edmonton Power's production costs and raise its requirement for natural gas to fuel the Rossdale plant.

The Board shares Edmonton Power's concern over the effect of a single outage to one of the two 904L circuits which presently provide the main supply to Jasper Terminal. The Board believes that a double outage to both of these circuits, which Edmonton Power also contemplated in arguing the need for 930L, is remote. If it did occur, it could be mitigated by standby capacity from the existing lower voltage 72-kV network to the Jasper Terminal. Provision for a future second circuit on the proposed 930L structures is, in the Board's view, prudent.

In summary, the Board finds that the proposed transmission line and associated facilities are needed by late 1980.

5 ROUTE OF THE TRANSMISSION LINE

5.1 Views of the Applicant

The applicant considered several possible routes, and selected, as most appropriate, a 12.9 km route which runs west from the Jasper Terminal Station along 105 Avenue to 191 Street, and then turns north to the proposed ring-road in Edmonton's Restricted Development Area (RDA) until meeting Calgary Power's 905L transmission line. From there, the proposed line would parallel the existing right of way for 905L east into the North Calder Substation.

A 90-foot right of way would be acquired on 105 Avenue, and a 100-foot right of way would parallel the ring-road. Edmonton Power proposed that the edge of the ring-road and right of way be separated by 130 feet, of which 60 feet adjacent to the ring-road would serve as a buffer zone, and the remaining 70 feet as a possible future transmission line right of way for circuits that might come into the corridor from the west.

Edmonton Power stated that the proposed route was selected because it would make maximum use of the transportation and utility corridors in the RDA. Following the proposed ring-road would allow the most efficient use of land for the two projects.

An alternative route, running directly north from Jasper Terminal along 170 Street into the RDA and then following the proposed ring-road to North Calder, was rejected because:

(a) although shorter than the proposed route by 4.1 km, it would cost some 1.4 million dollars more;

(b) 170 Street has been widened north of 105 Avenue to tie in with a future major traffic interchange and railroad underpass, and no suitable alignment for the proposed transmission line could be determined; and

(c) this alternative route would not utilize the utility corridor in the RDA.

Edmonton Power stated that, except for the trimming of a few trees for which Mrs. Duke would be compensated, her property would remain virtually untouched.

5.2 Views of the Interveners

Mr. Babie contended that he is unable to develop his property because the exact route of the ring-road is still uncertain; that the proposed route along 105 Avenue would render development on his property frontage impossible; and that the proposed route of the transmission line is not the most expedient. He further stated that the applicant had not fully explored all possible alternative routes.

Mary Duke submitted that the proposed line, where crossing her property, would necessitate removal of several storage structures as well as stands of trees used as windbreaks. Although she did not object to having the line cross her property, she did object to a line within 60 feet of her residence. She proposed that the line be set back further from her residence.

5.3 Views of the Board

In the Board's view, the route proposed by the applicant is the most appropriate. The alternative route, although some 4 km shorter, would not make optimum use of the RDA and also entails substantially higher cost.

The Board notes that Edmonton Power did not at this time see a definite need for the second circuit on the proposed structures, and was even more vague about possible circuits on the 70-foot space proposed west of the applied for right of way. Moreover, the Board believes that land within the RDA would be available for better use in the future if the right of way for the transmission line were shifted slightly to the west to abut directly onto the buffer zone planned for the proposed ring-road. The Board notes that this would, coincidentally, also provide some relief for Mrs. Duke by increasing the distance between her residence and the line. The applicant has undertaken to not remove any of her buildings.

With respect to the interventions by T. L. Babie et al, the Board considers that the concerns relate here primarily to uncertainties over the detailed siting and construction schedule for the ring-road, and not to the transmission line itself. In the Board's view, a transmission line along 105 Avenue could be built so that it would not in any real sense preclude development fronting the property line for industrial purposes (as projected by Mr. Babie).

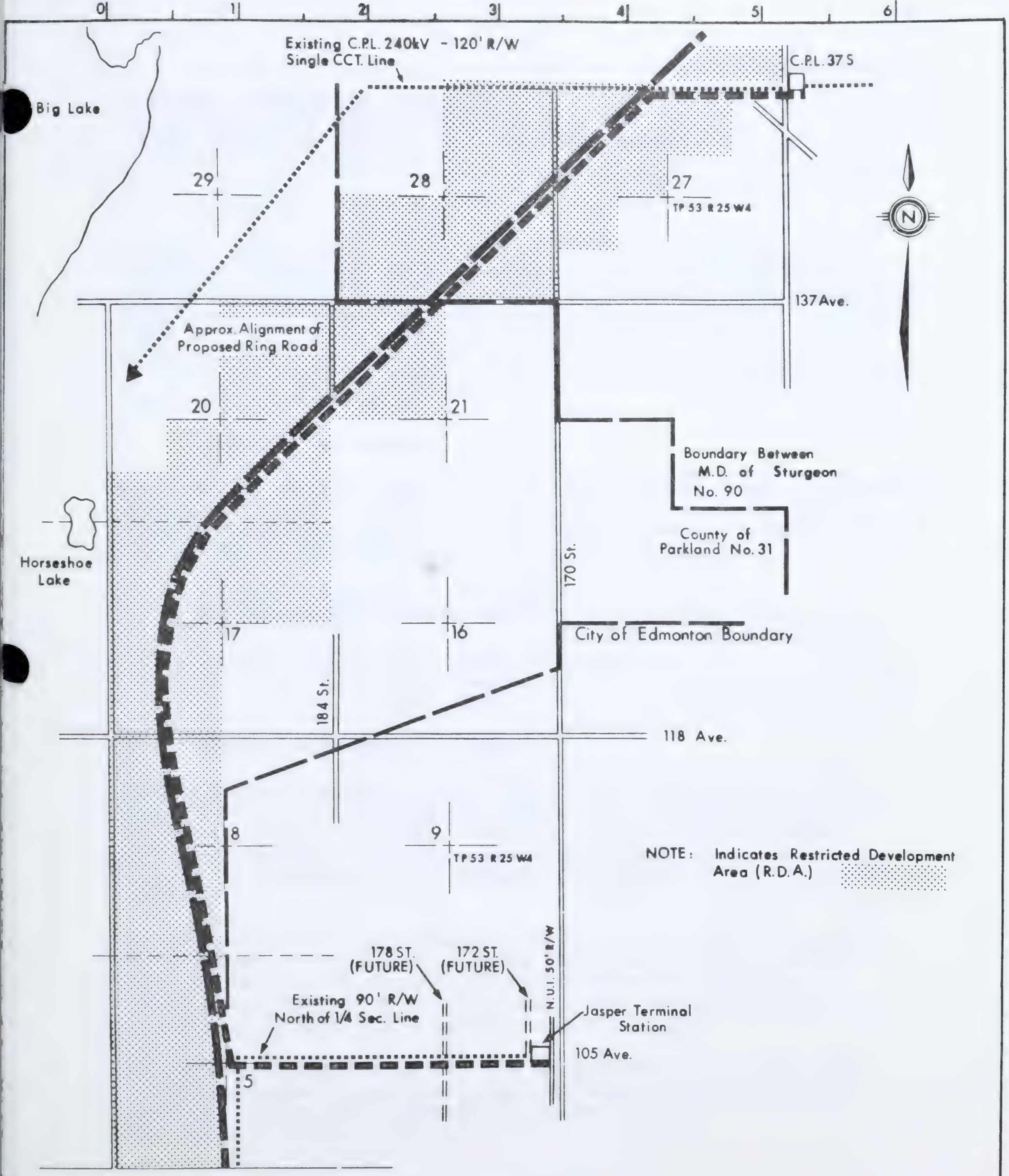

FIGURE 1
PROPOSED ROUTE OF JASPER TERMINAL
NORTH CALDER TRANSMISSION-LINE EP 930L.

ADDENDUM TO ERCB DECISION REPORT 80-14
IN THE MATTER OF A 240-KV TRANSMISSION LINE FROM JASPER TERMINAL TO NORTH CALDER IN NORTHWEST EDMONTON

1 BACKGROUND

On 8 July 1980, the Board heard an application by Edmonton Power for approval to construct a 240-kV transmission line in northwest Edmonton. The Board's decision on this application is contained in ERCB Report 80-14. Subsequently, on 25 November 1980, Alberta Environment filed a statement under section 26 of the Board's Rules of Procedure, requesting that the Board vary its decision to allow locating the transmission line some 70 feet further away from the west boundary of the power corridor planned within the west Edmonton RDA.

2 RE-OPENING OF HEARING

On 12 January 1981, the Board re-opened the hearing in Calgary to consider Alberta Environment's request, with N. Berkowitz, P.Eng., (Chairman), C. J. Goodman, P.Eng., and J. A. Bray, P.Eng., sitting. Those who appeared at the re-opened hearing were as shown below:

- Alberta Environment represented by Mrs. June Reay
- Edmonton Power represented by Mr. Alex Sadesky, P.Eng. and
  Mrs. Janet Franklin, Solicitor
- Board Staff: Mr. M. Bruni, Solicitor
  Mr. D. Beamer, C.E.T.
  Mr. J. Cole

3 ALBERTA ENVIRONMENT'S EVIDENCE

Alberta Environment submitted that the route applied for by Edmonton Power conformed to a corridor plan developed by a technical committee of representatives from industry and from municipal and provincial government agencies. That plan, which has been adopted by the Alberta government, designates specific areas within the RDA for specific utilities.

At the hearing Alberta Environment noted that the corridor plan allowed for placement of a future transmission line between a highway buffer strip and the presently applied-for transmission line, and that it provided some flexibility for the proposed ring road in the event that planners had to shift that slightly to the east or west.

Alberta Environment also advised that the property of Mrs. Mary Duke, who had intervened at the 8 July 1980 hearing as a directly affected landowner, had now been acquired for corridor purposes.

4 DECISION

Having regard for the evidence filed by Alberta Environment, and for the minor nature of the requested revision, the Board is prepared to vary its original decision and thereby grant Edmonton Power a permit and licence to construct the transmission line in the originally proposed location along the right of way.

However, the Board is not convinced that sufficient space for a second transmission line, between the buffer zone and the line now approved, would in fact be available. The Board therefore emphasizes that its decision on the present application has no bearing on the disposition of a future application for a transmission line in the area.

DATED at the City of Calgary, in the Province of Alberta, this 20th day of January 1981.

N. Berkowitz, P.Eng.
Vice Chairman

C. J. Goodman

C. J. Goodman, P.Eng.
Board Member

J. A. Bray, P.Eng.
Acting Board Member

AL.1.1?8

ENERGY RESOURCES CONSERVATION BOARD
Calgary Alberta

Decision 80-15
Applications 790677,
800109, and 800113

APPLICATIONS FOR PERMITS TO CONSTRUCT PIPELINES IN THE GRANDE PRAIRIE AREA

1 APPLICATIONS AND HEARING

1.1 The Applications

The Board received three applications to build a pipeline to transport liquids from the Deep Basin Area of northwest Alberta. The Deep Basin is a rapidly developing gas and oil area bounded on the southwest by the disturbed belt with the northern edge uncertain (see Figure 1).

Application 790677 by Peace Pipe Line Ltd. is for a permit to construct approximately 240 kilometres (km) - (150 miles) of 323.9 millimetre (mm) - (12.75 inch) outside diameter pipeline for the transmission of crude oil, ethane, propane, butanes, and condensate from a point in legal subdivision 15, section 31, township 72, range 8, west of the 6th meridian to its existing Fox Creek facilities in Lsd 8-36-62-20 W5M. The liquids would then be transported to the Edmonton area through existing pipelines.

Application 800109 by Federated Pipelines Ltd. is for a permit to construct approximately 460 km (288 miles) of 114.3 mm (4.5 inch), 168.3 mm (6.625 inch), 219.1 mm (8.625 inch), and 273.1 mm (10.75 inch) outside diameter pipeline for the transmission of crude oil, ethane, propane, butanes, and condensate from Lsd 9-3-74-12 W6M and other collection points to its existing Swan Hills facilities at Lsd 5-19-66-9 W5M. The liquids would then go through existing pipelines to the Edmonton area.

Application 800113 by Dome Petroleum Limited is for a permit to construct approximately 460 km (288 miles) of 168.3 mm, 219.1 mm, 273.1 mm, and 323.9 mm outside diameter pipeline for the transmission of crude oil, ethane, propane, butanes, and condensate from a point in Lsd 5-3-82-11 W6M to a point in Lsd 14-28-53-12 W5M in the general Edson area. The liquids would then move, either to the Edmonton area or, west through existing pipelines. The Dome application involves two alternative routes in the area north of Edson. These routes along with the routings of the other applied for lines are shown on Figure 2.

1.2 The Hearing

A hearing, to consider the applications, was held in Grande Prairie from 28 April to 2 May 1980, and in Calgary from 5 May to 7 May 1980 and from 12 May to 16 May 1980 with G. J. DeSorcy, P.Eng., V. E. Bohme, P.Eng., and C. J. Goodman, P.Eng., sitting. The Parties who appeared at the hearing are listed in Appendix 1.

2 THE NEED FOR A PIPELINE TO SERVE THE DEEP BASIN

2.1 Views of the Participants

The applicants and oil and gas industry interveners were unanimous in their support of the need for a pipeline to transport crude oil and natural gas liquids from the Deep Basin area. None of the local interveners in the Grande Prairie area questioned the need for a pipeline.

While all three applicants supported the need to serve the area from La Glace - Wembley to Lator (shown on Figure 1 to be from about township 73 south to township 62), only Dome indicated the need to serve an area from Lator to Obed (about township 62 to 52), which latter area is referred to in this report as the "southern portion of the Deep Basin". Dome claimed a high potential for development of production from the southern portion of the Deep Basin based on results from drilling 17 wells of confidential status, geological data, significant Crown land sale purchases, and the extremely high drilling activity in the area.

The applicants and the industry interveners generally agreed that a pipeline to serve the area should be capable of carrying crude oil and natural gas liquids either in batch or blended form and also indicated that, if volumes reached sufficient quantities, the pipeline should be capable of transporting segregated batches of crude oil, ethane, propane, and butanes.

Peace and Federated contended that Dome's forecast of production from the southern portion of the Deep Basin was unrealistic and speculative since it was not based on any current production of crude oil or natural gas liquids from the area. Only three of the industry interveners supported Dome's contention that the southern portion of the Deep Basin needed to be served by a pipeline at this time. Although there were differences in the production forecasts between each of the applicants, the forecasts for the La Glace - Wembley to Lator areas were generally similar.

With respect to the need for more than one pipeline into the area, the applicants and industry interveners agreed that it would be inefficient for more than one pipeline to be built. Peace indicated that if more than one permit were granted it was possible that more than one pipeline might be built, resulting in a significant increase in the total investment in pipeline facilities to serve the area. Peace claimed it would not be in the public interest for more than one project to proceed at this time. Dome indicated that if the Board were to issue more than one permit, it would be the first one to build because it is, and intends to remain, the largest single producer of liquids in the Deep Basin area. Dome stated there should only be one permit and one pipeline. Federated also maintained that only one application should be approved.

The industry interveners generally indicated that two or more pipelines into the Deep Basin area are not justified by reserves, or the need for competition; would have an adverse impact on the environment, and would encourage wasteful construction. They suggested there was no justification for granting a permit for more than one pipeline to serve the Deep Basin area.

2.2 Views of the Board

The Deep Basin is a source of hydrocarbon liquid production today and is a highly prospective area for future liquid production. On the basis of the evidence presented at the hearing, particularly the forecasts of production and the geological evidence, the Board concludes there is a definite need for a liquids pipeline to serve the Deep Basin area. It does not, however, see a need for more than one line and in this respect agrees with all three applicants. The Board also agrees with certain of the participants that if more than one line were approved, circumstances are such that more than one might be built and this would be contrary to economic, efficient and orderly development. Accordingly the Board will not approve more than one of the subject applications, which in turn necessitates a detailed comparison of the proposals.

The Board agrees that substantial liquid production will occur from the Deep Basin but considers the Dome forecast to be optimistic at this time because it is largely based on future potential rather than on proven or probable reserves. The Board expects production from proven and probable reserves will be closer to the volumes forecast by Federated. The Board notes that the Peace projection of production was not an actual forecast so the Board will not comment on it relative to the production which the Board would expect from the area.

The production of natural gas liquids could increase significantly with the installation of deep cut facilities.[1] However, the potential for this is considered to be speculative because of the uncertainty of markets and prices for ethane, and uncertainty regarding the willingness of producers to install deep cut facilities.

The Board sees potential in the so-called southern portion of the Deep Basin but believes essentially all future production from there would come from what would now have to be termed as "possible" reserves. The Board believes, on the basis of the evidence presented at the hearing, that the production rate from the southern portion of the Deep Basin will likely be much lower than forecast by Dome. Peace and Federated did not include a projection of production from the southern area.

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[1] "Deep cut" facilities as used in this report refers to facilities installed at gas plants to improve the efficiency of natural gas liquid recovery including the recovery of ethane.

The Board, even though it recognizes that there is potential for production from the southern portion of the Deep Basin, believes that because little proven reserves and production exist, there is no urgent need for a main line through the southern area. The Board recognizes that because of the high level of activity in the area, significant increases in the knowledge of the area's potential will likely occur in the next year or so. This could serve to substantiate Dome's proposal, however, it would also allow for a more precise determination of an appropriate pipeline location. In summary, the Board does not believe that the serving of the southern portion, by only the Dome proposal should dictate that the Dome proposal be approved, particularly at this time. The Board does recognize that this serving of the southern portion could be an advantage to the Dome proposal and the matter will be discussed further as part of the comparison of the applications.

3 COMPARISON OF THE APPLICATIONS

3.1 Introduction

As mentioned in the preceeding section the Board believes it should approve only one of the subject applications. This necessitates a detailed comparison of the proposals. The Board believes the appropriate factors which should be considered in making the comparisons are as follows:

(i) impact on landowners or occupants including residences and agricultural or other land uses by individuals,

(ii) impact on other industries such as forestry or mining,

(iii) impact on the environment including matters such as wildlife, forests, groundwater, recreation areas, and river crossings,

(iv) the technical design, operation, and safety of the facilities,

(v) economic factors including total cost, ownership provisions, and economic impact on the province, and

(vi) service which would be provided to the oil and gas industry, such as the range of products that could be moved, the volumes to be moved, the areas to be served, and the receipt and delivery points.

One of the problems which the Board faces in making its comparison and one which caused considerable difficulty at the hearing, is that the proposals do not serve identical areas or in the same manner and consequently are not directly comparable. For example, one proposal may be considerably more costly than others but it may serve a much larger potentially productive area. It would not be fair to penalize such a proposal because it is more costly than the others. In another instance, one proposal might suffer from an environmental view point because it included a lateral to serve one particular field and which would necessitate a difficult river crossing. Other applications might not have included the lateral to serve the field and yet, if one were approved, the lateral may have to be built. It would be unfair to penalize the first proposal due to the environmental impact of the river crossing it identified. In order to facilitate a meaningful comparison the Board has modified each of the proposals before it, with respect to the areas to be served. The Board does not intend to compare the "modified proposals" with respect to all of the factors listed above, rather, only those where it believes a modified comparison to be appropriate. The Board emphasizes that the modifications are for purposes of a meaningful comparison only and that it is not modifying the actual applications. In approving one of the applications the Board would approve only the application as presented at the hearing and not any of the modifications which it developed solely for comparative purposes.

In modifying the three proposals, the Board considered several general matters which it believes would help put the applications on an equal basis. Firstly, from the evidence presented, an assessment was made relating to the main areas of current and future production. Current forecasts revealed a range of rates but were in general agreement as to location of the main sources of production. The main sources were the Gold Creek, Kakwa, Elmworth, and Wembley fields. Other secondary sources of production include Karr, Lator, and Steeprock. For comparative purposes, the Board ensured that the modified proposals each served these areas.

Assumptions regarding lateral size (outside diameter in millimetres) were made as a result of evidence presented and the Board assumed that a 168.3 mm pipeline would be required between South Wapiti and Elmworth and a 114.3 mm pipeline between Elmworth and Steeprock. Areas to the north including Bonanza, Balsam, Josephine, Cecil, and Dunvegan show a reasonably good aggregate volume, but more than one applicant agreed that an extension to include such areas could not be economically justified at this time. Federated in fact withdrew its proposed lateral to Valhalla during the course of the proceedings. The Board therefore excluded service to those areas in making a comparison of the applications.

In considering the southern portion of the Deep Basin, the Board projected a system of "equal service" to the area south of township 62, and north of Edson. For the Peace and Federated proposals, and in order to make them directly comparable to the Dome application, the Board modified the proposals by including main lines from the north and south which would service the southern portion of the basin. For the case of the Dome application, which bisects the south area, no modifications were assumed between township 62 and Edson, except for a lateral to service the Lator-Karr areas. The Board recognizes that some mileage of laterals would be required from the Dome route in the southern section, however, considering the present stage of development within the area, the Board chose to consider only those "mainline connections" necessary to service potential production from the area. Therefore, the Board has not estimated a total pipeline length or cost for those local gathering facilities which, in any case, would likely be about equal for the Dome proposal and each of the other two modified proposals.

3.2 The Modifications

3.2.1 Modifications to the Peace Application

The Peace application is summarized in Figure 3 and consists of 240 km (150 miles) of 323.9 mm pipeline, from a point near Grande Prairie (72-9 W6M), to its existing Fox Creek facilities. The applied for route originates near the Wembley field and extends roughly south, skirting the eastern edge of the Elmworth field. The route extends southeast, passing through the Kakwa field and then proceeds easterly through the Lator field to Simonette. The present line between Simonette and Fox Creek is then looped by the applied for line.

The Board made the Peace proposal comparable to the others by including a lateral to the Elmworth field, and also assumed that those volumes originating at the Gold Creek plant would be transported via the Koch pipeline to Valleyview. The Board futher considered that an extension of the Elmworth lateral to the Steeprock area and the addition of a lateral to Karr would be logical to make the applications comparable.

To service the potential production in the southern portion of the Deep Basin (south of approximately township 62), the Board assumed a lateral extending south from the Peace route in the presently designated Lator field (63-2 W6M). The Board has estimated that the total length of lateral required would be approximately 68 km (43 miles). The envisioned lateral would extend due south from the Lator field and south-easterly following approximately the proposed Dome route to the Berland River. A second lateral was considered as extending from Edson, north-westerly to a point in township 57, south of the Berland River. Two river crossings would be involved in such a lateral (Athabasca and Wildhay), and this lateral would extend approximately 90 km (56 miles). From the evidence presented, the Board concluded that both of these laterals would be 168.3 mm outside diameter.

3.3.2 Modifications to the Federated Application

Federated applied to construct a total of 460 km (288 miles) of 114.3 mm, 168.3 mm, 219.1 mm, and 273.1 mm pipeline as indicated on Figure 4. A significant percentage of the Federated application involves specific tie-in laterals, one of which (Valhalla), was withdrawn during the course of the hearing.

In order to assess the three applications on an equal basis, the Board reviewed the evidence and concluded that, even if the 168.3 mm pipeline connecting Steeprock to Sinclair could be justified, deletion of this section of pipeline and extension of the Karr lateral to Lator would enable a comparison to be made on a fully equal basis.

To allow for the potential production in the southern portion of the Deep Basin (south of Lator through Obed), the Board considered laterals similar to those modifications used for evaluation of the Peace application. The Karr-Lator lateral was extended south from the Lator area along the route described for the similar lateral addition to the Peace application. An identical lateral from Edson was then considered for the area south of the Berland River. These laterals were both considered as being future tie-ins to the Federated system. It was also assumed that volumes from the Simonette plant would continue to be shipped via the Peace system, and therefore would be unavailable to Federated.

3.2.3 Modifications to the Dome Application

The Dome application, shown on Figure 5, covers the construction of a total of approximately 460 km (288 miles) of 168.3 mm, 219.1 mm, 273.1 mm, and 323.9 mm outside diameter pipelines. This application did not include any laterals, but did include what Dome considered to be an optimized routing to tie-in future volumes expected south of the Lator field. Stage 1 of the Dome application extends essentially south from the Wembley area through the South Wapiti area and then south and east through the Cutbank Field. It continues approximately in the same direction into an area immediately north of Obed. The line then swings to the east, continuing to Edson and on to Niton. Stage 2 covers that section north from Wembley to approximately Silver Valley, however, Dome indicated that this section, although applied for, would not be built for "a year or so". For comparative purposes, the Board excluded the Stage 2 portion of the Dome application and added laterals to Elmworth and Steeprock, and to Lator and Karr. As well, for the purposes of comparison, liquid volumes from the Gold Creek and Simonette plants were assumed not available to the proposed Dome pipeline.

3.3 Comparison of the Applications (Modified as Appropriate)

3.3.1 Impact on Owners And Occupants

The Peace and Dome routes traverse a country residential subdivision in NE 6-72-8 W6M. Both are committed to locate and construct any pipeline in such a manner that it would have virtually no ill effects on the proposed subdivision or the marketability of the lots. The Board therefore believes that neither of the proposed pipelines should detrimentally affect the proposed subdivision.

Peace suggested several potential soil- and agricultural-related problems such as soil compaction, mixing subsoil and topsoil, and increased soil salinity on solonetzic soils. It advised that prior to construction it will develop a reclamation plan that would take into account site-specific problems and landowner concerns. It also advised that a qualified agrologist would be employed to supervise soil conservation and agricultural reclamation procedures.

Dome indicated that its land agent would work closely with the landowners before, during, and after construction of the pipeline to ensure the landowner is aware of the company's activities. These activities could be modified at the request of the landowners. Dome anticipated close co-operation with individual landowners, and disking of soil following backfilling of trenches to mitigate any impacts on agriculture.

Federated evaluated soil characteristics as part of its route selection process and identified areas where compaction, trafficability problems, and solonetzic soils could result in impacts on agriculture. The construction and reclamation procedures proposed reflect these problems and Federated promised that qualified staff would be on site to supervise. In addition, close liaison would be maintained with landowers.

The Board observes that the Dome and Peace proposals as modified for comparison purposes would affect approximately the same amount of agricultural land while the Federated proposal affects a somewhat larger area because it crosses the agricultural area of Valleyview. Although the Federated proposal would affect more agricultural land it is the Board's opinion that this is not a significant disadvantage, because the impact of a pipeline on agriculture would be minimal provided the construction is carried out having particular regard and care for topsoil conservation and other potential agricultural impacts. In summary, the Board concludes there is little to choose between the proposals insofar as impact on landowners and occupants is concerned.

3.3.2 Impact on Other Industries

Peace claimed that its proposed route would create the least impact on forest operations. Its contention was based on the belief that, because the route passes through what it considers the centre of the prospective trend, the length of any possible future laterals would be minimum. Peace would attempt to satisfy the concerns of forest operators as soon as possible by making minor route adjustments and modifying clearing and construction procedures where practicable. Dome also claimed its route would create minimum impact and expressed a willingness to discuss the Kakwa Tower route proposed by Proctor and Gamble and the requirements for possible future laterals. Dome also promised to work out with the forest operators mutually satisfactory solutions to the concerns. Dome indicated that cutlines, roads, and other rights of way, would be used where convenient to minimize conflict with the forest industry. Federated contended that it considered the forest industry in route selection and its proposed route affects only small amounts of high quality timber.

Neither Proctor and Gamble nor North Canadian Forest Industries intervened in favour of any of the applicants. They explained the nature of their concerns and concluded that, providing satisfactory discussions are undertaken by the successful applicant, any of the proposals could be acceptable. Their concerns for the short term were:

(a) that timber salvage be to specifications set by the forest operators to obtain full value of the timber,

(b) the loss of timber in inaccessable areas due to high cost of timber salvage, and

(c) the use of roadways, especially during winter operations.

The concerns of Proctor and Gamble and NCFI for long term were:

(a) the attrition of the forest resource base and its effect on the allowable annual cut, and

(b) the fragmentation of the resource base and the disruption of age/class stands reducing long term efficiency of harvesting operations.

The Proctor and Gamble and NCFI representatives expressed the belief that much can be done to resolve the short term impacts by planning and close co-operation between the forest industry and the applicants. However, to be successful in minimizing short term impact, the concerns of the forest industry must be resolved by August 1980, at which time the forest operators will be finalizing their schedules for the 1980-81 winter season.

With respect to the Dome and Peace applications, the representatives of the forest industry indicated that it may be possible to resolve many of their concerns by modest alterations to the route, however, they preferred that Dome and Peace evaluate the potential of placing their pipeline contiguous with the Kakwa Tower road from where it crosses the AGTL Elmworth Lateral to the junction of the Proctor and Gamble trunk road in township 65-7 W6M. In comparing the modified proposals, the Board notes that the Federated proposal would cross a significantly greater area of forested land than the Peace proposal which, in turn, affects a significantly greater area than does the Dome proposal. This does not necessarily mean that the Federated proposal has the greatest impact on forest operations in that it follows existing rights of way to a greater extent than do the Dome and Peace proposals. The Board recognizes that all three proposals affect significant areas of forest land. The Board believes that many of the concerns of the forest industry and the impact on forest resource productivity can be resolved at the detailed route planning stage by requiring close co-ordination between the pipeline and forest industries and the Alberta Forest Service. Accordingly, the Board does not see any significant difference in the three proposals insofar as potential effects on forest operations are concerned.

The most westerly alternative route proposed by Dome for the area north of Edson would affect a potential coal mining area near Obed. Representatives of Union stated that it would oppose the Dome proposal with the western alternative route for that reason. Dome indicated it had selected the eastern route to avoid conflict with coal resources. The Board agrees that such is the case and does not believe that potential impact on the coal mining industry is a factor which would result in an advantage or disadvantage to any of the proposals.

3.3.3 Impact on the Environment

All three applicants presented evidence regarding the environmental impact of their proposed pipelines. The applicants gave varying weights to environmental considerations in routing their lines. Because all lines as modified by the Board would serve the same fields or areas, the impact of the final routes in the Deep Basin would be much the same for each proposal.

Peace said it would use existing access roads and cut-lines as much as possible and would mitigate impacts on wildlife through construction timing and revegetation. Dome proposed an alternative route in the Obed area which was intended to avoid some critical wildlife areas and provide for summer access and construction of the Wildhay and Athabasca Rivers. It also proposed to use existing access where possible to reduce clearing and to time construction activities to mitigate wildlife impact. Federated proposed to use existing access where possible. Its route would use the pipeline right of way to Valleyview but a new right of way would be continued to Swan Hills. An alternative route was proposed for the Valleyview-Swan Hills section to reduce the impact on wildlife in the Goose River area.

The proposals as modified by the Board would affect several critical wildlife areas as well as key wintering areas for ungulates. However, the Board is of the opinion that providing the applicants adhere to the Government resource management objectives and adopt appropriate mitigative procedures, none of the proposals would have a significant advantage over the others in terms of wildlife impact.

Several river valleys in the Eastern Slopes have a high capability for recreation, and the areas affected by the modified proposals are the Kakwa, Smoky, and Little Smoky river valleys. These river valleys

are all affected by the modified Peace and Dome proposals. However, Dome expressed an interest in evaluating the potential of crossing the Smoky and Kakwa rivers at the same location as the future Highway 40. The Federated proposal could affect water quality downstream at Bald Mountain campsite operated by Proctor and Gamble and Federated has committed to minimize any such problem.

In summary, the Peace and Dome proposals would affect three recreation areas, while the Federated proposal would affect only one. In each instance, reference is to the proposals as modified to make them comparable. Notwithstanding that the Peace and Dome proposals traverse two more recreation areas than does the Federated, the Board is of the opinion that this does not necessarily mean that the impact would be significantly greater. Providing that the applicants adhere to the Government's resource management objectives and adopt appropriate mitigative procedures, none of the proposals would have a significant advantage over the others, but the Federated proposal would have a modest advantage.

Respecting river crossings, the Peace application included geotechnical and hydrological information for all major crossing points. Potential instabilities have been identified at the crossings of the Wapiti and Smoky Rivers and they have been surveyed to ensure that all potential problems are taken into account. Peace would also survey all other water crossings to determine where any geotechnical or hydrological engineering may be required. Dome did not conduct any geotechnical or hydrological investigations to determine the suitability of the proposed river crossings. However, prior to construction a survey of the line would be conducted by a qualified consultant. Dome said it was not aware of any instability problems which would require other than standard procedures. Federated conducted geotechnical and hydrological surveys on all major river crossings. All major crossings in its proposal, except the Wapiti, have previously been used by other pipelines. This would reduce the amount of new disturbance in these sensitive areas. The applicant stated that it is prepared to relocate the proposed Wapiti crossing to the existing AGTL crossing subject to AGTL's agreement.

The Board notes that the proposals, modified for comparison purposes, involve one more major river crossing for Peace than for Dome and

Federated, and that the Federated proposal utilizes several existing crossings. Certain of these new crossings are potentially unstable. For the above reasons, the Federated and Dome proposals offer some advantage in terms of river crossings. This advantage is not overwhelming, however, because the Board is of the view that the crossings could be properly accomplished on any of the routes, if the construction occurred at the proper time of the year and was subject to proper engineering and construction methods.

3.3.4 Technical Design, Operation, and Safety

Dome and Peace both propose to ship crude oil, pentanes plus (condensate) and propane-butane mix (gas plant liquids). Federated has designed its pipeline to handle crude oil, condensate, and gas plant liquids with vapour pressures up to almost 2750 kPa (400 psi). The applicants proposed to batch the products in the following methods:

(a) Peace - crude oil
- condensate (pentanes plus)
- plant liquids (propane-butanes)

(b) Federated - crude oil
- "slop" (ethane, propane, butanes, and pentanes plus)

(c) Dome - crude oil
- condensate (pentanes plus)
- plant liquids (propane-butanes)

Under the Peace proposal, products from the Deep Basin would be transported through the proposed Peace system to its existing facilities at Fox Creek. From that point, the crude oil and liquids would be transported in the existing pipelines to Edmonton, with the plant liquids being shipped in a segregated pipeline.

The proposed Federated pipeline would deliver the products to existing Federated facilities at Swan Hills. From Swan Hills the liquids mixture would be shipped via an existing 273.1 mm pipeline to Edmonton. This line is currently licensed to carry crude oil and an amendment to this licence would be required in conjunction with the Federated Deep Basin proposal. Crude Oil would be shipped through two other existing Federated oil pipelines from Swan Hills to Edmonton. The Board notes that some additional pipeline would be required to tie-in the liquids line to potential delivery points in the Edmonton refinery area.

Dome proposed to ship all Deep Basin crude oil to the Transmountain Oil Pipeline Company terminal at Edson. The crude would then be transported via the Transmountain system to the west coast for refining. Dome also indicated that a limited amount of the condensates could be marketed via the same route, and the remainder could be transported to Edmonton via a Niton-Pembina pipeline tie-in involving Amoco and Co-ed systems from Niton.

Each applicant provided information as to the pump station and power requirements necessary for various levels of throughput on its system. In general, one, two, and four station configurations were required for the initial, mid-term, and ultimate volumes projected. All three applicants included some provision for storage, however, there were differences in approaches and products and therefore, differences in the storage facilities estimated to be necessary.

Both Dome and Peace included some provision for pressurized storage for propane and butanes. Because Federated had not planned to handle segregated propane and butanes, it did not include any pressurized storage. All three applicants, however, included atmospheric storage to accommodate the receipt of truck shipments and to handle intermediate and delivery point situations relative to the operation of its pipeline.

The approximate capacity for each system was given as follows for a four station configuration:

System	Daily Capacity (cubic metres)	(barrels)	Maximum Operating Pressure (kilopascals)	Pounds per sq inch
Peace	15 240	96 000	8 274	1 200
Federated	10 635	67 000	9 652	1 400
Dome	12 540	79 000	9 652	1 400

The daily capacity available at present without modifications to existing systems was estimated as follows:

System	(cubic metres)	(barrels)
Peace	8 570 to 12 380	54 000 to 78 000
Federated	17 460	110 000
Dome (Amoco Liquids Line)	667	4 200
(Pembina Oil Line)	1 190	7 500

All applicants proposed to design and construct to the latest CSA Z183 standard. In addition Peace proposed to bury the pipeline with 120 centimetres (cm) - (4 feet) minimum cover for those lengths of pipeline traversing agricultural land. Dome proposed to provide similar depth of cover in the vicinity of Edson. Peace and Dome both showed a preference regarding the location of mainline block valves; each indicating that wherever possible valves would be located with regard to accessability. Neither Peace nor Dome gave consideration to providing remote-operated block valves. On the other hand, Federated had considered and was proposing to use solar or electrically powered remote valve control facilities at strategic locations.

All applicants planned to provide 24-hour manned supervision of the pipeline operations. As well, all applicants proposed a computer controlled volume balancing system with a sensitivity in each case being a volumetric balance within one-half of one per cent. Volume balancing would be supplemented by regular aircraft inspections as well as on-the-ground inspections at river crossing locations twice a year and at periods of high water. All applicants proposed to have available an emergency contingency plan meeting Board requirements and to have training programs aimed specifically at handling high vapour pressure products.

The Board notes that all three applicants routed the pipelines to avoid areas of population. The Board concurs with this philosophy and further believes that risk is also reduced by minimizing, to the extent possible, the total length of pipeline required.

In summary, the Board is satisfied that all three proposed lines would be designed and operated in safe and sound manner and that none has a significant advantage over the others in this regard.

3.3.5 Economic Factors

At the hearing, much evidence was submitted respecting costs and tariffs, indeed, all the applicants made statements suggesting commitments of tariffs at certain levels and for certain time periods. The Board does not believe that it should evaluate the economics of the competing proposals on the basis of "offered tariffs" and will not deal further with this aspect of the matter. Rather, the Board considers that its economic appraisal should reflect the actual cost of service which would occur under each proposal, including capital and operating costs. In order that these cost estimates would be comparable, the Board, as it has for several other factors, looked at the modified proposals. Where facilities were added or deleted to make the proposals comparable, the Board added or deleted costs for such facilities on the basis of evidence presented at the hearing. The Board also reviewed, to ensure consistency, the cost estimates submitted by the applicants.

The Board evaluated the cost of servicing the currently productive portions of the Deep Basin area at throughput rates of 2381 and 4762 cubic metres per day (m^3/d) - (15 000 bbls/d and 30 000 bbls/d). The proposals were then further modified to service both the areas with existing production and the areas which might become productive in the near future, and again the total annual cost was determined at a throughput rate of 4762 m^3/d. Municipal and corporate income taxes were not included in the cost of service calculation because they do not represent a true resource cost. The calculation did incorporate repayment of capital, including working capital, plus a reasonable return, along with the average annual operating cost which includes a modest escalation to accommodate pipeline aging. The analysis was made for a 25-year life.

The results obtained from the evaluation are presented in Table 1. They indicate that the cost of servicing points of existing production would be lower if the Peace proposal was approved for throughputs of either 2381 or 4762 m^3/d. The Board recognizes that the results summarized in Table 1 are not precise due to the complexities of the comparison but believes the 10-20 per cent advantage shown for Peace is indicative of what would actually occur. The table shows that, even if modifications are made to the Peace proposal to service points of potential production in the southern portion of the Deep Basin, the cost of service for the Peace proposal would be relatively similar to the Dome proposal and both of these would be lower than the Federated proposal. The Board interprets these calculations to indicate a cost of service advantage to Peace with Dome ranked second and Federated third. Furthermore, the Board sees some advantage in routing a pipeline through the southern area at a later time when the points of production could be specifically identified. This advantage can not be quantified, but would be realized if either the Peace or the Federated applications were approved.

The Board wishes to emphasize that its cost of service calculations summarized in Table 1 are not intended to duplicate a typical tariff calculation nor to indicate what the tariffs should be for the various proposals. Rather, it is a cost of service calculation done on an equivalent basis to facilitate what the Board considers to be a reasonable comparison. It should also be noted that Table 1 reflects costs related to proposals as modified for comparison purposes, and so for this reason also, it could not be considered to represent the Board's interpretation of appropriate tariffs for each of the proposed pipeline systems.

All of the applicants would offer opportunities for other producers in the Deep Basin to participate in ownership of the pipeline. The Peace offer appears to be more restrictive than either Dome's or Federated's and, consequently, the Board sees it with a modest disadvantage in this respect.

The construction phase of the pipeline is expected to generate employment and stimulate economic activity in the area of the Deep Basin. However, the applicants estimated that the permanent direct employment associated with pipeline operation would be less than seven people. The proximity of the proposed pipeline to the potential of the Deep Basin would stimulate exploration and development because any decline of transportation costs would increase the revenue to the producer. The route proposed by Dome would likely have the greatest immediate impact on exploration and development, while the route proposed by Federated would likely have the least. Although no detailed analysis was attempted, the Board believes the economic impact on the Province associated with any of the three proposals to be substantially positive.

3.3.6 Service to the Industry

The maintenance of product integrity and the ability to transport high vapour pressure products were two issues of major concern to the interveners.

With regard to the existing systems, Dome would exchange volumes of pentanes plus and natural gas liquids at Niton, for equivalent volumes of similar product in Edmonton. Federated would transport the natural gas liquids mix from Swan Hills to Edmonton through an upgraded line, and batch the Deep Basin crude in its own oil line. Peace has suggested that it may be necessary to blend the Deep Basin crude oil with other oil presently moving from Fox Creek to Edmonton. In this case, equalization payments would be made in accordance with the quality of the crude. Peace also stated that it could move oil to Edson for shipment west if judged appropriate. Pentanes plus and the natural gas liquids mix would be batched to Edmonton in separate lines.

The Board considers the throughput capacity of all three proposed systems to be more than adequate at this time. As mentioned earlier, the Dome proposal would have a modest immediate advantage of serving the southern portion of the Deep Basin. Additionally, the Board believes the Federated proposal to blend the pentanes plus with the other gas liquids may result in some additional cost in terms of refractionation upon arrival in Edmonton. The ability to carry ethane is not considered to be a significant advantage since the economic viability of field of extraction is unknown at this time. The Board considers the versatility of the Peace proposal, which would allow crude oil to be transported directly to either Edmonton or Edson, with only minimal complications, to be a potential advantage.

4 SUMMARY OF COMPARISON OF THE APPLICATIONS

A comparison of the applications with respect to many of the factors considered reveals very little relative advantage or disadvantage in each of the proposals.

With respect to owners and occupants, it is concluded there is no significant difference. The difference in impact on other industries is also considered minimal. The Federated and Dome applications would have a modest advantage from an environmental impact point of view as related to river crossings. However, all applications would be environmentally acceptable. All applications conform to the appropriate codes and standards and are considered to be acceptable as to technical design, operation, and public safety. Additionally, the Board concludes that, in total, there is little difference between the proposals respecting opportunities for producers to participate, economic impact on the Province, impact on oil and gas exploration, and service to the oil and gas industry.

A comparison of the likely resulting cost of service reveals the greatest difference between the applications. The costs of the Dome and Peace proposals to service existing and potential production were relatively similar, while Federated's was higher. However, the Peace proposal would cost less than either Federated or Dome's to service only existing production. Overall, the Board sees a significant advantage in this aspect in that Peace could proceed as it proposed and later, if judged appropriate, a pipeline to service the southern portion of the Deep Basin could be built with no significant penalty in terms of costs when compared with the present Dome proposal.

5 DECISION

The Board considers all three applications to be acceptable and in the public interest, but believes only one of the applied for pipelines should be approved and constructed. For the reasons stated in the preceding section, the Board is prepared to approve the Peace Pipe Line Ltd. Application 790677. The Board is requesting the approval of the Minister of the Environment and, upon receipt thereof, will issue a permit to Peace Pipe Line Ltd. Any permit issued would contain conditions generally as set out in Appendix 2, plus any other conditions included in the Ministerial Approval.

Since the other two applications under consideration are both acceptable, the Board will not dismiss them at this time. Rather, it will defer decision on these applications and will provide 30 days from the date of issuance of the permit for Peace Pipe Line Ltd. to indicate whether Peace will proceed with its proposal. If it does proceed, the applications of Federated Pipelines Ltd., and Dome Petroleum Limited will be denied. If on the other hand, Peace Pipe Line Ltd. decides not to proceed, the Board will issue an addendum to this report.

ISSUED at Calgary, Alberta on 20 August 1980.

ENERGY RESOURCES CONSERVATION BOARD

GJ DeSorcy

G. J. DeSorcy
Vice Chairman

VE Bohme

V. E. Bohme
Board Member

C. J. Goodman

C. J. Goodman
Board Member

TABLE 1 ESTIMATED COST OF SERVICE FOR PROPOSALS AS MODIFIED FOR COMPARISON PURPOSES[1]

CASE A: Servicing currently producing regions (the northern portion of the Deep Basin)

Applicant	Average Cost of Service (Net of Taxes) - Dollars per Cubic Metre (Dollars per Barrel) Cost at Throughput Levels 2 381 m^3/d (15 000 bbls/d)	 4 762 m^3/d (30 000 bbls/d)
Dome	7.06 (1.12)	3.84 (.61)
Federated	6.99 (1.11)	3.84 (.61)
Peace	6.24 (.99)	3.21 (.51)

CASE B: Including future potential producing areas (the southern portion of the Deep Basin)

Applicant	2 381 m^3/d (15 000 bbls/d)	4 762 m^3/d (30 000 bbls/d)
Dome		4.16 (.66)
Federated		4.91 (.78)
Peace		4.22 (.67)

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[1] The conversion factor used in this table and throughout the report to convert barrels to cubic metres is 6.3 barrels per cubic metre.

APPENDIX I THOSE WHO APPEARED AT THE HEARING

Principals and Representatives (Abbreviations used in Report)	Witnesses
Dome Petroleum Limited (Dome)	J. Andriuk, P.Eng., P.Geol.
W. J. Major, Q.C.	A. F. Balasch, P.Eng.
	J. M. Beddome, P.Eng.
	I. D. Endicott
	P. J. Grant
	H. R. Heffler, P.Eng.
	J. S. MacDonald, P.Eng., P.Geol.
	S. J. Savidant
	E. H. Scott, P.Eng.
	H. J. Strain, P.Eng.
	R. L. Suitor
Federated Pipelines Ltd. (Federated)	J. H. Geddes, P.Eng.
C. J. Cummings	G. W. Hollingshead, P.Eng.
B. J. Todesco	W. A. Jackson, P.Eng.
	D. Jones, P.Eng.
	C. E. Loiselle, P.Eng.
	B. Martens
	R. C. Osborne
	S. J. Stefanowski
	J. R. Wurzer
Peace Pipe Line Ltd. (Peace)	E. J. Archer, P.Eng.
C. K. Yates	M. C. Harris, P.Eng.
	R. A. Hemstock, P.Eng.
	J. A. Ion, P.Eng.
	D. A. James
	B. E. Massie
	J. W. Motley
	K. A. Rutt, P.Eng.
	I. R. Wilson
	E. K. Yaremko, P.Eng.
	E. A. Yasinko, P.Eng.
Alberta Energy Co. Ltd. (Alberta Energy)	
J. Meheriuk	
R. A. Towler, P.Eng.	
The Alberta Gas Trunk Line Company Limited (AGTL)	
L. C. Brown	
F. R. Foran	

APPENDIX 1 THOSE WHO APPEARED AT THE HEARING (continued)

Principals and Representatives (Abbreviations used in Report)	Witnesses
Amerada Minerals Corporation of Canada Limited D. C. Edie	
Amoco Canada Petroleum Co. Ltd. S. E. Lipton	J. R. Howerth J. S. Moore, P.Eng. D. A. Nickerson, P.Eng.
Canadian Hunter Exploration Ltd. J. A. Dillabough, P.Eng.	
Canadian Superior Oil Ltd. R. J. Lane	
CanDel Oil Ltd. R. Beattie	
Chieftan Development Co. Ltd. F. S. Dawson	
Esso Resources Canada Ltd. J. T. Daines	
Hudson's Bay Oil and Gas Company Limited R. M. Perrin	
Husky Oil Ltd. R. O. Drysdale	
Koch Pipelines (Koch) B. K. O'Ferrall R. R. Wilkinson	L. M. Narraway, P.Eng.
PanCanadian Petroleum Ltd. G. E. Little	
Petro-Canada Explorations Inc. D. Daffin	
Sulpetro Ltd. H. R. Ward	
Texaco Canada Resources Ltd. R. M. Boyer	R. S. Dedek N. H. Eggen, P.Eng. I. E. Varga, P.Eng. G. V. S. Whitaker, P.Eng. B. C. Winger, P.Eng.

APPENDIX 1 THOSE WHO APPEARED AT THE HEARING (continued)

Principals and Representatives (Abbreviations used in Report)	Witnesses
Total Petroleum (N.A.) Ltd. D. R. Chantz, P.Eng.	
Union Oil Company of Canada Ltd. (Union) R. G. Byers L. D. Rae	E. W. Beresford J. J. Sullivan, P.Eng.
North Canadian Forest Industries (NCFI) J. L. Bauer	J. L. Bauer
Proctor & Gamble Cellulose Ltd. (Proctor & Gamble) T. W. Barr	T. W. Barr B. MacDonald R. M. Watson
Bear Lake Farm Rights Group J. D. Carter	
Fred Drysdale Paulette Patterson Lloyd Friedel Catherine Rigler Lorne MacLeod A. Schubert	L. MacLeod
Energy Resources Conservation Board staff C. J. C. Page J. K. Moloney	
Alberta Environment K. Moir J. Robinson	

Submissions were also received from the following who did not appear at the hearing:

Shell Canada Ltd.

Aurey A. Carter

Yvonne C. Potter

Mr. & Mrs. N. Underwood

Archaeological Society of Alberta

APPENDIX II FORM OF CONDITIONS

ATTACHMENT TO PERMIT NO.

The conditions under which this permit is granted, in addition to the requirements of The Pipeline Act, 1975, and Regulations thereunder,

1. The permittee shall advise the Board within 30 days of the date of this permit whether it intends to proceed with the construction of the pipeline.

2 The permittee shall enter into discussions with the operators of Forest Management Areas to minimize the adverse impact of construction on forest management operations. Where differences cannot be resolved they may be referred to the Board.

3 Construction methods shall be designed and controlled to ensure that the crossing of agricultural land by the pipeline results in minimum impact on farming operations.

4 The permittee shall consult with Alberta Energy and Natural Resources to ensure it meets the spirit and intent expressed in the Government policy document "A Policy for Resource Management of the Eastern Slopes".

5 An emergency contingency plan acceptable to the Board shall be filed with the Board prior to the start of operation of the pipeline.

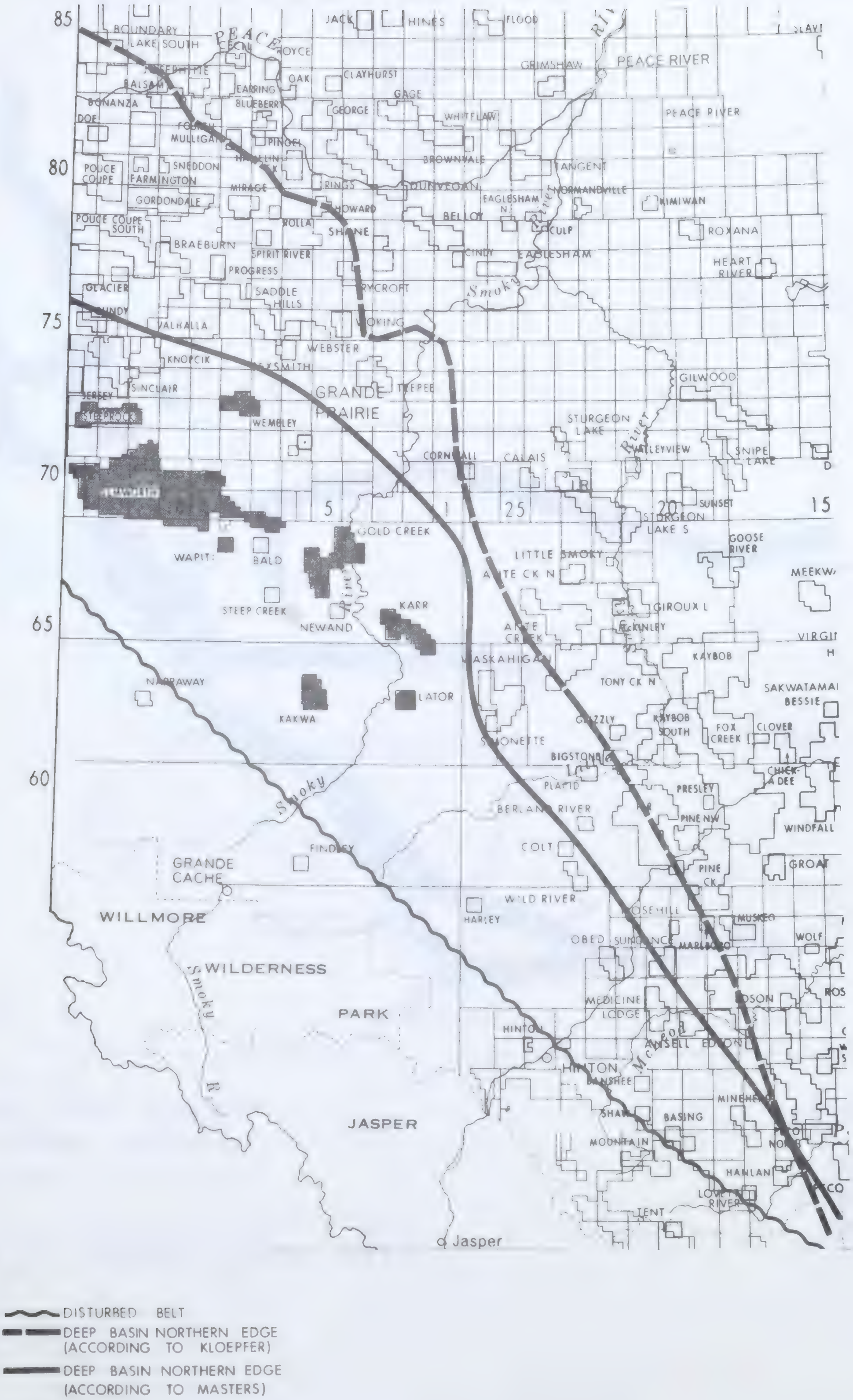
85
80
75
70
65
60
BOUNDARY LAKE SOUTH
PEACE
CECIL
HOYCE
JACK
HINES
FLOOD
PEACE RIVER
GRIMSHAW
BALSAM
BONANZA
EARRING
BLUEBERRY
OAK
CLAYHURST
GAGE
GEORGE
WHITELAW
PEACE RIVER
DOE
MULLIGAN
PINOEL
BROWNVALE
POUCE COUPE
SNEDDON
FARMINGTON
MIRAGE
RINGS
DUNVEGAN
TANGENT
NORMANDVILLE
GORDONDALE
HOWARD
EAGLESHAM N.
KIMIWAN
POUCE COUPE SOUTH
ROLLA
BELLOY
CULP
ROXANA
BRAEBURN
SHANE
SPIRIT RIVER
CINDY
EAGLESHAM
HEART RIVER
PROGRESS
Smoky River
GLACIER
SADDLE HILLS
RYCROFT
VALHALLA
WOKING
KNOPCIK
WEBSTER
SEXSMITH
SINCLAIR
GRANDE PRAIRIE
TEEPEE
GILWOOD
JERSEY
STEEPROCK
WEMBLEY
STURGEON LAKE
VALLEYVIEW
SNIPE LAKE
CORNWALL
CALAIS
5
1
25
20
15
SUNSET
STURGEON LAKE S
GOLD CREEK
WAPITI
BALD
LITTLE SMOKY
GOOSE RIVER
ANTE CK N
MEEKWA
STEEP CREEK
KARR
GIROUX L
NEWAND
ANTE CREEK
McKINLEY
VIRGIN
KAYBOB
MASKAHIGAN
NARRAWAY
TONY CK N
SAKWATAMAU
BESSIE
LATOR
KAKWA
GRIZZLY
KAYBOB SOUTH
FOX CREEK
CLOVER
SIMONETTE
BIGSTONE
CHICK-A DEE
PLACID
PRESLEY
Smoky
BERLAND RIVER
PINE NW
WINDFALL
FINDLEY
COLT
PINE CK
GROAT
GRANDE CACHE
WILD RIVER
HARLEY
WILLMORE
ROSEHILL
MUSKEG
OBED
SUNDANCE
MARLBORO
WOLF
WILDERNESS
Smoky R.
MEDICINE LODGE
EDSON
PARK
HINTON
ANSELL
EDSON
McLeod
HINTON
BANSHEE
MINEHEAD
SHAW
BASING
JASPER
MOUNTAIN
HANLAN
LOVETT RIVER
TENT
Jasper
DISTURBED BELT
DEEP BASIN NORTHERN EDGE (ACCORDING TO KLOEPFER)
DEEP BASIN NORTHERN EDGE (ACCORDING TO MASTERS)

FIGURE 1

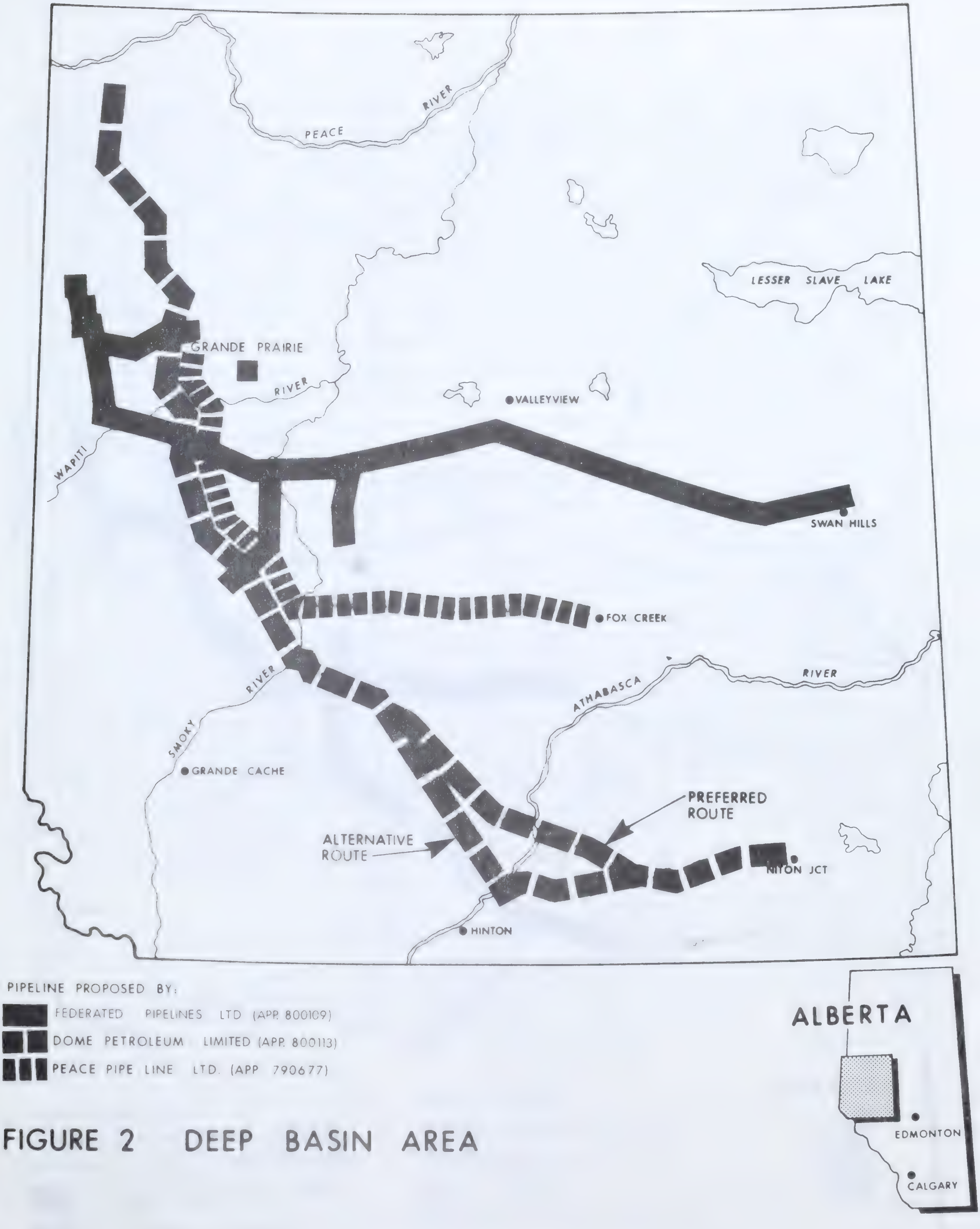

FIGURE 2 DEEP BASIN AREA

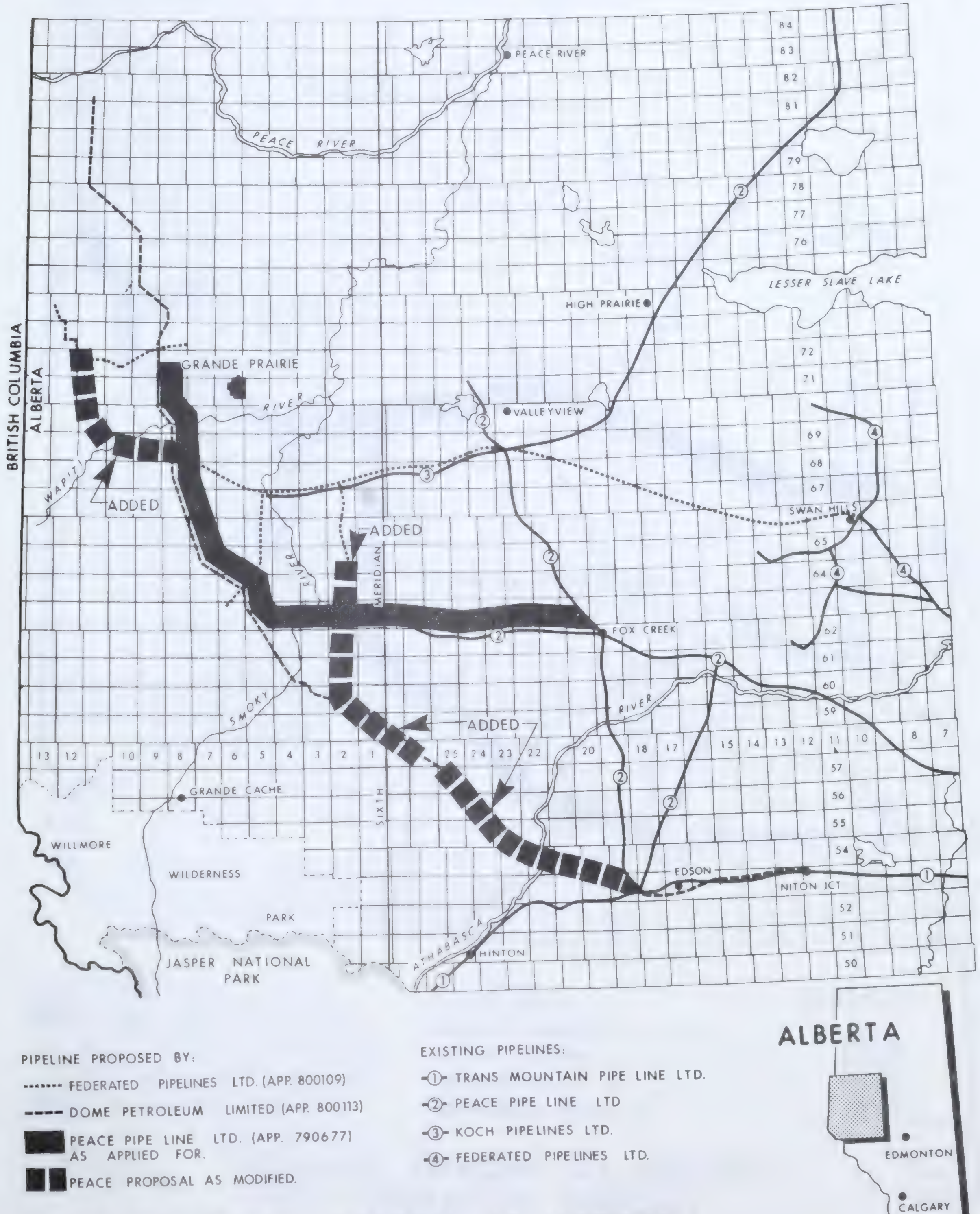

FIGURE 3 PEACE PROPOSAL AS MODIFIED FOR COMPARISON PURPOSES

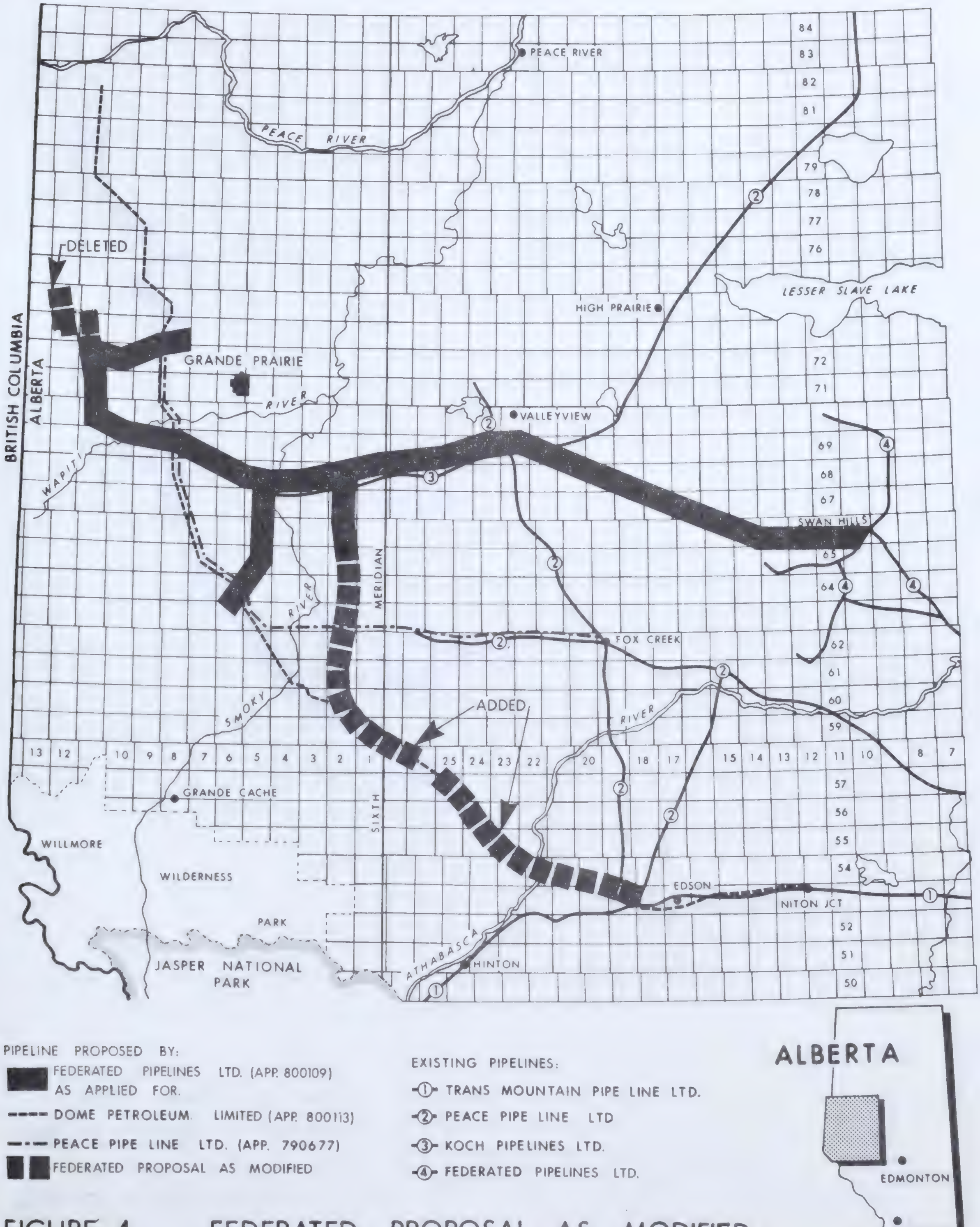

FIGURE 4 FEDERATED PROPOSAL AS MODIFIED FOR COMPARISON PURPOSES

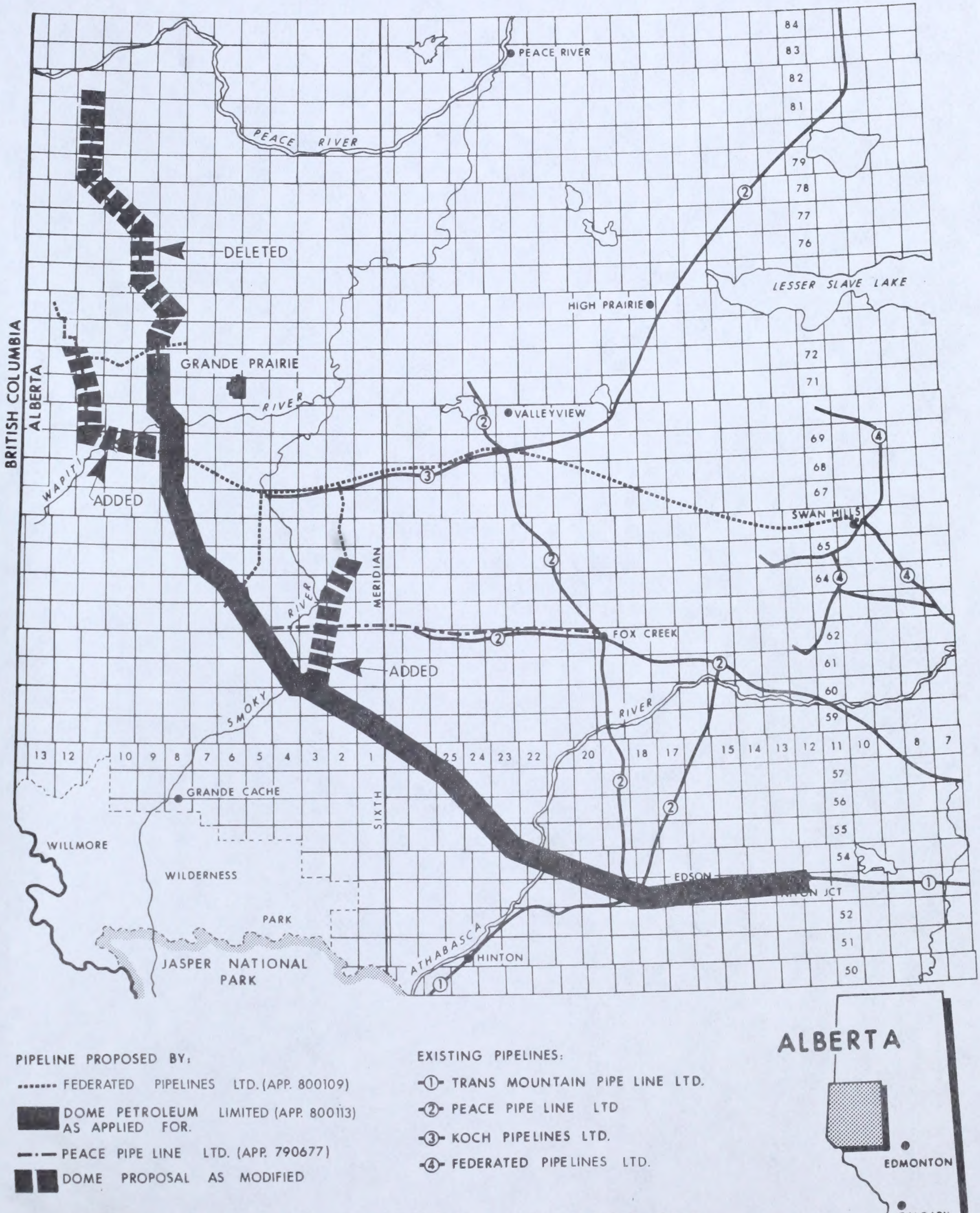

FIGURE 5 DOME PROPOSAL AS MODIFIED FOR COMPARISON PROPOSES